

NOATAK RIVER SONAR 1991 PROGRESS REPORT

by

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ABSTRACT

The Noatak River sonar project was designed to provide timely estimates of in-season escapement of chum salmon and Arctic char past commercial and subsistence fisheries in the Kotzebue area. This was the third year of operation at the sampling site, located at river km 39. Fish passage was estimated through single-beam hydroacoustic gear deployed on the right bank of the river from 10 July through 30 August. A gill net test fishery sampled the migrant fish population to provide information on which to base apportionment of sonar counts to species. A total of 110,089 fish passed the sampling site. The program estimated passage of 82,612 chum salmon (s.e. = 3,435), 10,329 char (s.e. = 2,297), 12,815 whitefish (s.e. = 2,404) and 1,752 pink salmon (s.e. = 464).

KEY WORDS: salmon, char, Noatak River, sonar, hydroacoustic, species apportionment, escapement

INTRODUCTION

Noatak River chum salmon (*Oncorhynchus keta*) and Arctic char (*Salvelinus alpinus*) support commercial and subsistence harvests in Kotzebue Sound and the lower Noatak River. Effective management of the fisheries resource requires knowledge of wild stock escapement. Two indices of escapement are currently available; 1) catch per unit effort (CPUE) data from a test-netting project near the river mouth, and 2) results from aerial surveys of clear-water spawning areas. Silty water and the wide, multi-channel river mouth preclude visual counts of migrating fish.

This project was designed to assess the feasibility of using hydroacoustic (sonar) techniques to count migrating Noatak River chum salmon and Arctic char. Sonar estimates of daily fish passage would provide timely escapement information to fishery managers. In addition, sonar estimates of annual escapement would enable prediction of future year run strength and could eventually be used to establish escapement goals.

The Noatak River flows approximately 680 km from its headwaters in the Schwatka Mountains to Kotzebue Sound. Multiple channels, slow current and/or unstable banks characterize the lower 30 km. The lower Noatak River canyon at km 39 (Figure 1) was chosen for sonar deployment because of the single, narrow channel, stable banks, proximity to the mouth, and favorable bottom profile. At km 39, the river is approximately 200 m wide and 20 m deep, and the river bottom has a relatively constant slope from both banks.

A camp was constructed and sonar first deployed at this location during July and August 1989 (Fleischman and Huttunen 1990). Unusually high and turbid water during summer 1989 adversely affected sonar performance, and there were also several equipment-related problems. Nevertheless, site characteristics appeared favorable. Test-netting at the site suggested that chum salmon might be spatially segregated from other fish species. If real, such segregation would minimize the usually difficult problem of apportioning sonar estimates of total fish passage to species; neither dual-beam sonar nor extensive test-netting would be needed to differentiate between chum salmon and other, smaller species. In 1990, test-netting suggested that chum salmon were spatially segregated to a lesser degree than in 1989. Water levels were lower, water clarity was higher and fish displayed pronounced schooling behavior through the bulk of the chum salmon run (Fleischman et al. 1990).

This report summarizes preliminary results of the 1991 field season. Objectives for 1991, in order of priority, were as follows.

- (1) To provide estimates of right bank chum salmon passage to fishery managers three times per week.

- (2) To continue to assess the physical and biological characteristics of the Noatak River as they affect our ability to count migrating chum salmon with sonar.
- (3) To continue to collect dual-beam sonar data.

METHODS

Sonar Data Acquisition

Sonar equipment included a Biosonics model 102 echo sounder; International Transducer Company (I.T.C.) 4°x7° elliptical dual-beam transducer; Biosonics model 111 thermal chart recorder; Biosonics Model 281 Echo Signal Processor (ESP), with associated software, installed in a Compaq 386/20e personal computer; and a Hewlett Packard model 54501A digital-storage oscilloscope.¹ The transducer was mounted on a metal tripod placed 2-5 m offshore, and was aimed with a remote-controlled dual-axis rotator manufactured by Remote Ocean Systems (R.O.S.).

Sound pulses were generated by the sounder at 420 kHz with a pulse width of 0.4 ms. Pulse repetition rate was 5 sec⁻¹; effective range (without compensating for attenuation) was 120 m. The narrow beam signal was routed to the chart recorder which ran continuously at a paper speed of 1/8 or 1/16 mm per pulse. Chart recorder threshold setting was 0.12 V.

The sonar equipment was installed and fully operational on 10 July. Collection of sonar data continued through 30 August. The sonar equipment ran continuously, 24 hours per day, seven days per week, excluding two daily fifteen minute periods, twelve hours apart, for generator refueling and maintenance. Data acquisition was occasionally interrupted when changing river conditions necessitated moving the tripod or re-aiming the transducer. Sonar operation was checked periodically throughout the day by sonar technicians.

Fish traces in 20-m range and 15-minute time intervals were tallied daily from chart recordings. Technicians shared the responsibility of counting fish traces and recording data four times a day. The project leader conferred with the technicians on interpretation and recording of the data each day to ensure interpretive consistency.

The ESP enabled customized filtering of returning echoes, automated data storage, and real-time monitoring of dual-beam data acquisition. We set minimum voltage thresholds and pulse width criteria, which ESP used to eliminate echoes not likely to have originated from fish. Minimum voltage thresholds were range-

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dependent and tailored to current signal-to-noise ratios, which varied due to changing river bottom profile and transducer aim. For each echo which met the acquisition criteria, the ESP wrote information on voltage, pulse width, and range to the personal computer hard disk. A new data file was automatically created every 15 minutes.

Water level, read from a staff gauge in the river, was recorded 2-8 times daily. Secchi disk readings were taken twice daily while test-fishing and water samples (500 ml) were collected on days when dual-beam data were collected. Water temperature and conductivity were recorded with each water sample. Conductivity was measured with a Cole-Parmer 01481-40 conductivity meter. A log of sonar operations, water and weather conditions was maintained.

We used a Lowrance X-16 fathometer to sample bank-to-bank transects with downward-looking sonar, with the objective of estimating cross-sectional distribution of fish in the Noatak. Transects began at the site of tripod deployment and ran straight across the river to the opposite bank, and then back. A total of eight samples were collected twice daily, at 0900 and 1500.

Test-netting

Gill nets were used to estimate species composition of passing fish. The following nets, all 45.7 m (25 fathoms) long, were deployed a total of 492 times from 10 July through 30 August:

- 1) 70 mm (2.75") mesh mono-twist (#1.5 x 10 strand) gill net, 126 meshes deep
- 2) 102 mm (4") mesh mono-twist (#1.5 x 10 strand) gill net, 70 meshes deep
- 3) 127 mm (5") mesh mono-twist (#1.5 x 10 strand) gill net, 56 meshes deep
- 4) 152 mm (6") mesh mono-twist (#1.5 x 10 strand) gill net, 47 meshes deep

We test-netted seven days per week from 10 July through 30 August at 1000 and 1600 hours. Nets were drifted in both nearshore and offshore areas until 06 August. In the nearshore area, one end of the net was controlled from a boat and the other was attached to a rope 23 m long which was walked along shore. Each net was then deployed from a boat and drifted through the offshore area, with the inshore end of the net approximately 50 m offshore. We determined that the offshore area was drifted inconsistently due to changing wind directions and current speeds, and we discontinued drifting in this area from 07 August through 30 August. Each drift originated 10 m below the tripod and lasted 10 to 15 minutes.

We drifted nets 1 and 4 twice a day and alternately drifted nets 2 and 3 once per day. Set-nets were deployed a total of 14 times from 07 August through 27 August. Nets 1, 2, 3, and 4 were set six, two, four, and two times. Individual nets were set from shore out to 23 m and were within 5 m upstream or downstream of the tripod.

Captured fish were removed from the net when the net was fully retrieved into the boat. Salmon were measured from mid-eye to tail fork, and other species were measured from snout to tail fork.

Data Processing

Estimating Total Fish Passage

Periodic set-netting from shore revealed moderate passage of humpback whitefish (*Coregonus pidschian*), low passage of Arctic char and longnose suckers (*Catostomus catastomus*), but very few upriver-bound chum salmon within 20 m of the tripod. Sonar counts and testnet results were therefore stratified into nearshore (0-20 m range, set nets), and offshore (20-120 m range, drift nets) strata. Since our objective was to estimate chum salmon escapement, and very few chum salmon were found in the nearshore stratum, only data from the offshore stratum were processed. Fifteen-minute target totals from 20 m to 120 m range were averaged by 24 hours, then multiplied by 96 (number of 15-minute periods in 24 hours) to generate daily estimates of total (offshore) fish passage.

Species Apportionment

Relative test-netting catch per unit effort (CPUE), adjusted for net selectivity, was used to generate daily estimates of species proportions. Set nets were used primarily to monitor near-shore species composition, which included few upriver-bound chum salmon at 0-20 m range. Therefore only drifted nets deployed beyond the 20 m range were used to apportion offshore fish passage. Because of the size selectivity of gill nets, catches from several nets were used to estimate the relative abundance of each species. Chum salmon relative abundance was estimated from catches in 4", 5", and 6" mesh nets. Arctic char relative abundance was estimated from catches in 2.75", 4", 5", and 6" mesh nets. Humpback whitefish relative abundance was estimated from catches in 2.75" and 4" mesh nets, and pink salmon (*Oncorhynchus gorbuscha*) relative abundance was estimated from catches in 2.75", 4", and 5" mesh nets.

Size selectivity of gill nets for chum salmon and char was estimated from 1990 Noatak test-netting data, following Peterson (1966). Peterson's method assumes that net selectivity is approximated by a normal curve function; estimates of means and standard deviations for these normal curves, for nets used on the Noatak River in 1991, are listed in Appendix A. We caught too few pink salmon and whitefish to calculate net selectivity for these species on the Noatak. Net selectivity parameters for pink salmon were calculated from 1986-1989 Yukon River sonar data and converted to Noatak net sizes. Whitefish catches were not adjusted for net selectivity.

Selectivity curves were used to adjust catches for differential probability of capture. The normal curves were scaled so that the probability of capture

(height of the curve) was 1.0 for fish of length equal to the net selectivity mean. Catches of fish of each length were divided by the height of the scaled curve at that length. For instance, the estimated selectivity mean for chum salmon in 6" gear was 657 mm, the estimated standard deviation 60.5 mm. A 600 mm chum salmon caught in 6" gear is $z = 57/60.5 = 0.94$ standard deviations away from the net mean. The height of the normal curve is 64% of its maximum at $z = -0.94$, so the estimated (relative) probability of capture is 0.64. Therefore catches of 600 mm chum salmon in the 6" net would be adjusted upward by a factor of $1/0.64 = 1.56$. In reality, due for example to tangling of large fish in small meshes, net selectivity functions probably are not normal (Hamley 1978). Furthermore, the effect of departures from normality grow larger with distance from the mean, where a normal function would predict low probability of capture and therefore high adjustment factors. Therefore, to be conservative and minimize inclusion of tangled fish, fish whose lengths were very different from the selectivity mean for that net were ignored. An arbitrary z value of 1.66, equivalent to an adjustment factor of 4.0, was chosen as the cutoff point; i.e., fish more than 1.66 standard deviations shorter or longer than the net selectivity mean were excluded from analysis.

After adjustment for capture probability, the new catch numbers were divided by effort (i.e., fathom-hours corrected for differences in net depth) to calculate CPUE. If fish of a given size were susceptible to capture by more than one mesh size (criterion: fish length less than 1.66 standard deviations from the selectivity mean for that net), adjusted catch was divided by the total effort expended for all mesh sizes meeting that criterion. Adjusted CPUE was then summed over all length classes for each species, and species proportions were calculated as species CPUE divided by total (all species) CPUE.

To generate passage estimates by species, data were pooled into two "reporting periods" per week. Test-netting data for each reporting period were pooled to generate estimated species proportions, which were then multiplied by each day's sonar count for the three or four day report period. Reporting periods were scheduled to provide the most timely information for fishery managers.

Estimating Variance

There are at least two components that contribute to the variance of species passage estimates: (1) the sonar estimate of total fish passage, and (2) the test-netting estimates of species proportions. For the purposes of variance calculations, the sonar component of variance is assumed to be zero and errors in species passage estimates are due almost solely to estimation of species proportions.

To estimate variance of species proportions during a given reporting period (Equation 1), we treated each day's test-netting catch as a replicate cluster sample and weighted each sample by relative total (adjusted) CPUE for that day (Cochran 1977:64). Variance of species passage estimates was then simply

variance of the proportions multiplied by the square of the total fish passage estimate (Equation 2). Species passage variance estimates were calculated for each three or four day reporting period, then summed to get variances of the season totals (Equation 3).

$$\text{Spp proportions } (\hat{p}_i) \quad \text{var}(\hat{p}) = \frac{1}{n_i} \sum_{k=1}^{n_i} \left(\frac{m_k}{\bar{m}_i} \right)^2 \frac{(p_k - \hat{p})^2}{n_i - 1} \quad (1)$$

where: p_i = estimated proportion of one species (say chum salmon) out of total fish passage during reporting period i
 n_i = number of test-net samples (i.e., days) in reporting period i
 m_k = test-netting CPUE (all species) on day k
 \bar{m}_i = mean daily test-netting CPUE during reporting period i
 p_k = estimated proportion of one species during day k
 k = 1 to n_i days

$$\text{Spp passage } (\hat{z}_i - \hat{y}_i \hat{p}_i) \quad \text{var}(\hat{z}) = \hat{y}_i^2 \text{var}(\hat{p}) \quad (2)$$

where: z_i = estimated passage of one species during reporting period i
 y_i = estimated total fish passage during reporting period i

$$\text{Seasonal spp. passage } (\hat{Z}) \quad \text{var}(\hat{Z}) = \sum_{i=1}^n \text{var}(\hat{z}_i) \quad (3)$$

where: n = number of reporting periods in the season

Sonar and test-netting data were entered into QuatroPro worksheets and an Rbase for DOS database, respectively. Data processing was done with SAS (Release 6.03, see Appendix B).

RESULTS

River Conditions and Their Effects

During the period from 28 July through 30 August, which encompassed the bulk of the 1991 chum salmon run, little or no rain fell and water level dropped gradually and remained very low (Figure 2). Water clarity increased to the highest level during this time period. Similar water level and clarity conditions were experienced in 1990 and 1991 and subsequent observed fish schooling behavior appeared to be related to these water conditions during the two years.

Schooling behavior

Fish were initially distributed randomly in space and time during the early part of the season, but the distribution changed to clumped from late July until the end of the season. This was apparent from the manner in which chum salmon were captured in our test nets, and from clustering of fish traces on the chart recordings (Figure 3). Schools of 15-20 fish were not uncommon.

Diel fish passage

Fish passage at times exhibited a pronounced diel pattern. Passage rate was often slowest during the darkest part of the day from 1:00 to 5:00 A.M. This pattern was more evident when passage rates were moderately high and as dark hours increased.

Fish Passage

An estimated 110,089 fish passed 20-120 m from the right bank while the sonar was in operation from 10 July - 30 August (Table 1). The total estimate of fish by species included 82,612 chum salmon (s.e.= 3,435), 10,329 char (s.e.= 2,297), 12,815 whitefish (s.e.= 2,404) and 1,752 pink salmon (s.e.= 464). The period during which the highest estimated chum salmon passage occurred was between 13 and 17 August (Figure 4). From 10 July through 30 August we caught 701 chum salmon, 46 char, 131 humpbacked whitefish, and 37 pink salmon in drift nets (Appendix C). Two starry flounder (*Platichthys stellatus*), four least cisco (*Coregonus sardinella*), and seven longnose sucker were also taken, primarily in set nets. An additional six chum salmon, six char, and 12 humpbacked whitefish were caught in set nets. Data from drift gill nets was used to apportion offshore sonar counts (Figure 5). These data indicated that 75% of offshore fish were chum salmon, 12% were humpbacked whitefish, 9% were char, and 2% were pink salmon.

Cross-sectional Distribution of Fish in the River

Bank-to-bank transects were sampled from 17 July through 22 August. A total of 266 individual transects were collected during this time period. No positively identifiable fish traces were detected.

Target Strength Data Analysis

Dual-beam data records were collected on 29 of 49 days from 10 July through 27 August. Data was collected during daily periods of highest target passage over the entire counting range of the sonar. On 31 July, calibration data were collected using a copper sphere of known acoustical size (-42 dB) at two separate ranges. The 25-mm-diameter standard target was deployed at 18 m and 27 m and data was collected for 30 minutes at each range. We mathematically adjusted software calibration and processing parameter files to correct for transducer beam angle roll-off and signal attenuation coefficients. Once we adjusted the standard target data to its known acoustical size we used those processing files to estimate target strengths of fish within the sonar counting range. Final analysis showed that data collected with a 420-kHz frequency signal cannot be used to determine accurate target strengths due to variability of the attenuation of signal strength.

DISCUSSION

This was the third season of operation for the Noatak River sonar project, and the first year of providing inseason estimates of right bank chum salmon passage to fishery managers. Sonar deployment and operation using a single-beam system has been successful for the past two years and estimates of species passage and sampling error have been generated.

Water clarity appears to affect migrant fish behavior in the Noatak River. Low water levels observed in 1990 and 1991 resulted in high water clarity. Secchi readings from 3 to 5 meters were recorded in 1991 during the time period corresponding to maximum fish passage at the sonar site. Pronounced fish schooling behavior occurred during periods of high water clarity in both years. This behavior may be responsible for difficulties encountered in detection of fish with downward-looking sonar. Also, schools or individual fish may avoid the transect boat when the water is clear. If high water clarity persists in future years, spatial expansion factors will have to be estimated by some other method.

Since the fish detection problem has been documented in 2 out of three years, it appears unlikely that the downward-looking transect technique for spatial expansion of sonar data will be applicable at this site. This could be accomplished, however, with data collected from the left bank and relayed to the right bank via radiotelemetry. This technology will be implemented and evaluated on the Kuskokwim River during the summer of 1992. The successful implementation of the radio-link would allow collection of data from both banks simultaneously while operating the equipment from the right bank only.

Species apportionment on the Noatak will not occur based solely on distance from shore. While almost no upriver-bound chum salmon were captured nearshore (0-20 m), offshore (>20 m) passage estimates of chum salmon were >95%, 62%, and 75% in 1989, 1990, and 1991. Other means of determining species composition (e.g., test-netting and dual-beam analysis) will be developed and evaluated.

The test-netting method used in 1990 and 1991 appears to be the most functional and logistically consistent means of apportioning species at this time. The nets used in 1991 hang deeper in the water column than those used in 1989 and 1990 and sample the water more effectively. By deploying this present suite of nets (2.75", 4", 5", 6") more frequently (six drifts/day), we feel that we have provided satisfactory estimates of species composition with reasonably good precision. Standard errors of chum salmon passage estimates for 1990 and 1991 are 7% and 4% of the season total.

Dual-beam sonar, which would apportion sonar counts to species based on target strength, has been considered as an alternative apportionment method which would not require intensive test-netting. Size distribution of fish on the Noatak does appear to be favorable for dual-beam separation of species (Figure 6) however, accurate target strengths cannot be determined with the use of 420 kHz due to the attenuation of the high frequency signal. Attenuation of high frequency (420 kHz) sonar signals occurs with range within riverine systems (P. Skvorc, ADF&G, Anchorage, personal communication). Effective signal range reduction is directly related to increased conductivity. Attenuation coefficients as high as 0.56 dB/m have been calculated for the Noatak River. This level of attenuation is unacceptable for processing 420 kHz dual-beam data for target strength information.

Summary

We currently have an effective means of estimating chum salmon passage (right bank only) using a single-beam sonar system. Efficient data processing allows reporting of timely escapement estimates and associated sampling error can be reported to fishery managers.

However, results from 1991 operations have shown that:

- 1) sampling transects with downward-looking sonar is not feasible during periods of clear water, and
- 2) 420 kHz is not producing reliable data for use in species apportionment.

To further increase the accuracy of estimating chum salmon escapement levels, we recommend that the entire cross-sectional area of the river be ensonified at the sonar site. This could be accomplished by initiating left bank data collection with radio-link technology.

A change of frequency from 420 kHz to 120 kHz is also required for further advancement of this project. The change would permit emission of an unattenuated signal, allowing collection of accurate target strength information and, ultimately, species composition estimates based on fish size.

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Table 1. Estimated right bank (20-120 m range) fish passage, total and by species, at the Noatak sonar site from 10 July through 30 August 1991. Fish passage and estimated species percentages are calculated by three and four-day reporting periods.

Report Period Ending	Period Total Passage	Estimated Percent (s.e.) of Total				Estimated Report Period Passage			
		Chum	Char	Pink	White	Chum	Char	Pink	White
12JUL91	2,570	37(28)	17(19)	0	46(32)	955	444	0	1,171
16JUL91	2,390	94(6)	0	0	6(6)	2,239	0	0	151
19JUL91	1,959	17(12)	5(4)	0	77(8)	339	106	0	1,514
23JUL91	2,172	40(15)	0	2(3)	52(16)	877	0	53	1,125
26JUL91	3,159	43(16)	0	5(3)	51(16)	1,354	0	158	1,616
30JUL91	5,903	68(11)	1(1)	6(4)	25(11)	4,039	54	357	1,425
02AUG91	4,239	81(11)	3(3)	2(2)	9(6)	3,444	146	94	371
06AUG91	14,169	83(6)	6(4)	2(1)	9(4)	11,699	840	306	1,323
09AUG91	4,842	92(2)	0	4(4)	03	4,473	0	199	0
13AUG91	8,927	87(2)	5(2)	2(1)	3(3)	7,754	449	137	276
16AUG91	23,269	83(9)	5(3)	0	6(7)	19,252	1,187	0	1,414
20AUG91	17,413	60(11)	31(11)	2(2)	7(3)	10,377	5,431	360	1,245
23AUG91	7,066	86(8)	14(8)	0	0	6,086	981	0	0
27AUG91	7,521	79(11)	2(2)	1(1)	15(12)	5,938	162	88	1,158
30AUG91	4,491	84(10)	12(11)	0	0	3,787	528	0	0
	-----	---	---	---	---	-----	-----	-----	-----
Total	110,089					82,612	10,329	1,752	12,815
s.e.						3,435	2,297	464	2,404
s.e./total						0.042	0.222	0.265	0.188
Overall %		75	9	2	12				

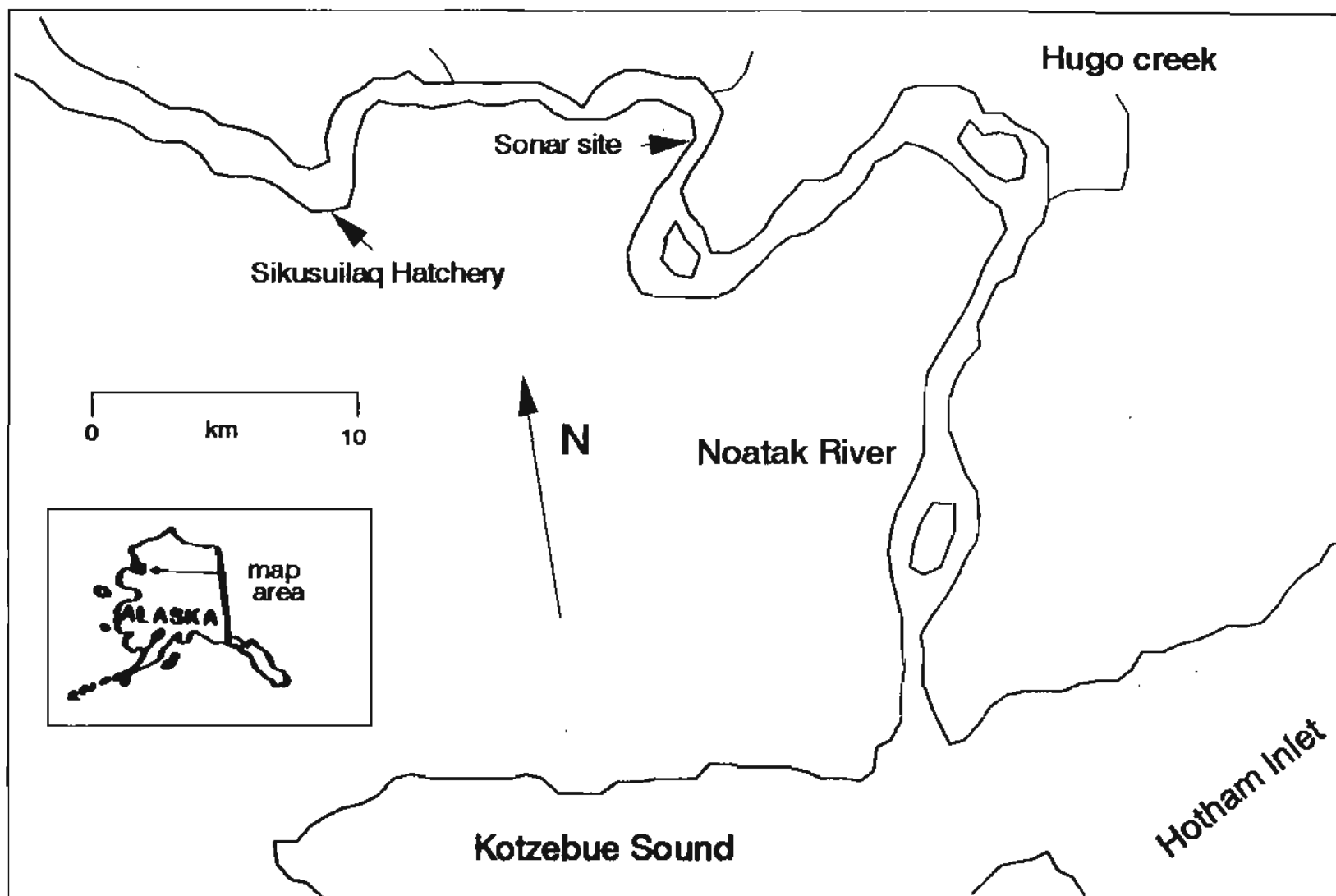


Figure 1. Location of Noatak River sonar at km 39, 1989, 1990, and 1991.

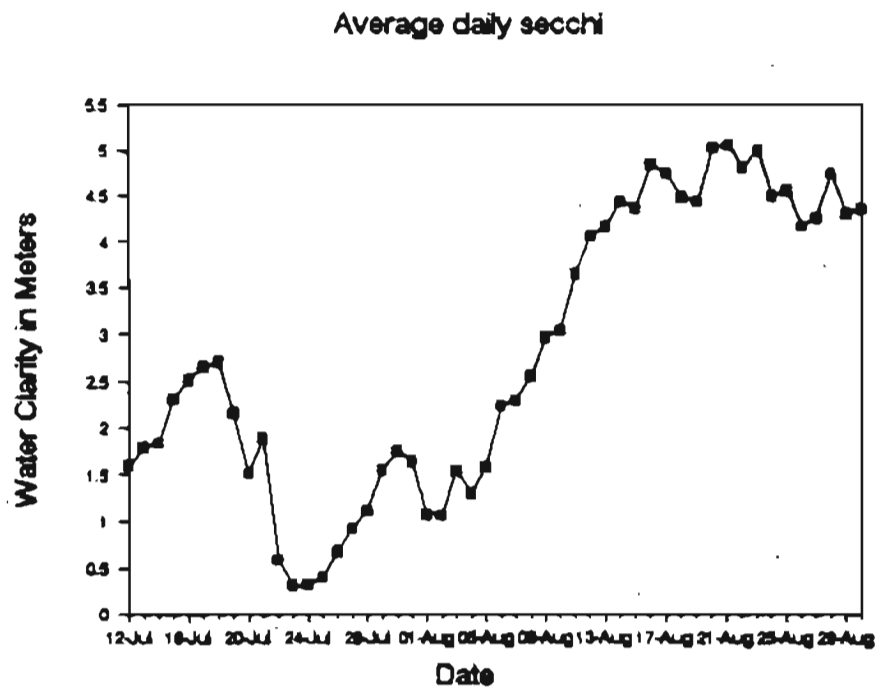
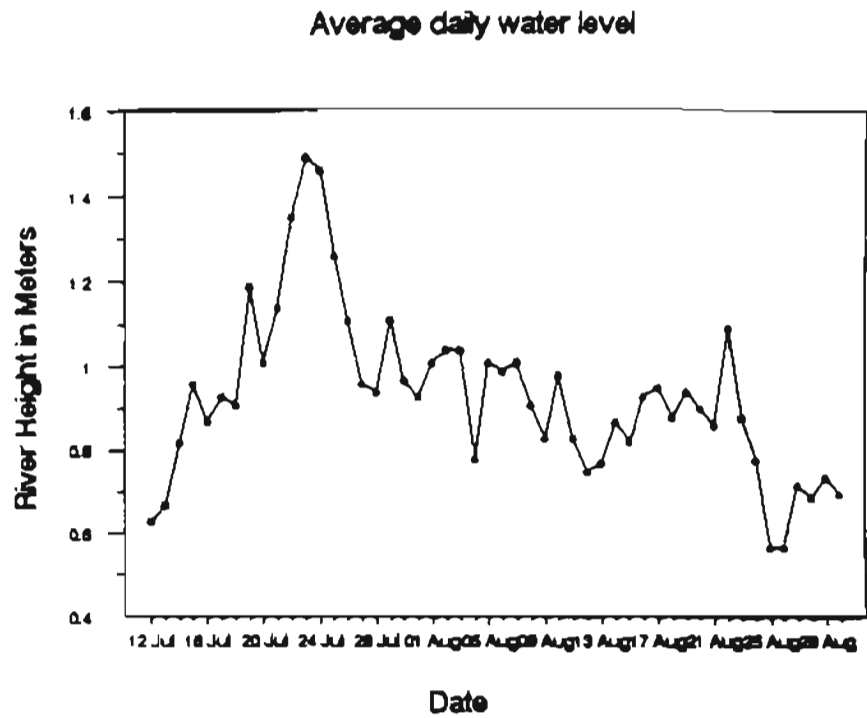


Figure 2. Mean daily water level (meters) and water clarity (meters secchi disc visibility) from 12 July through 30 August, Noatak River sonar, 1991.

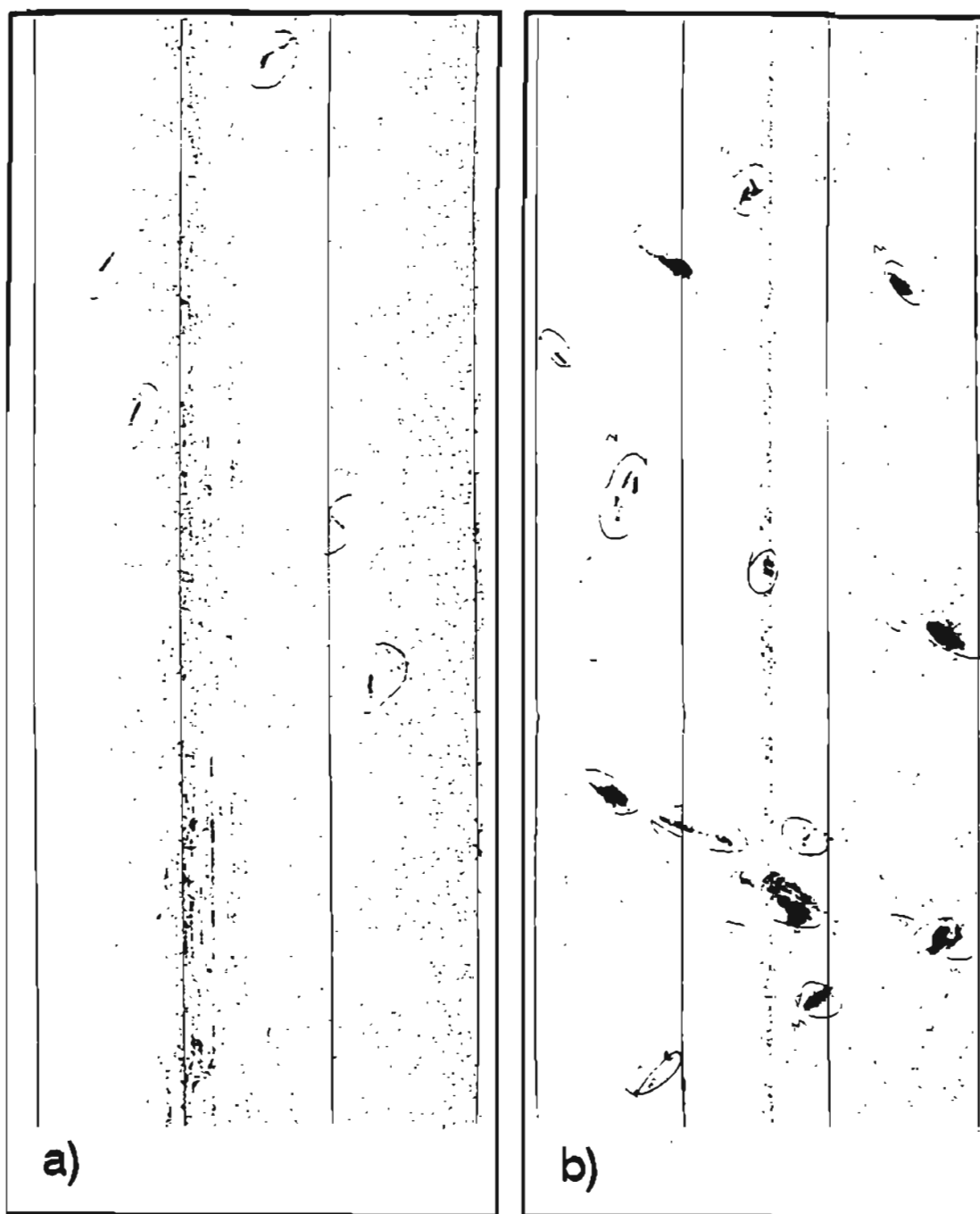


Figure 3. Chart recordings showing a) earlier season random traces and, b) later season clustered traces, Noatak River sonar, 1991.

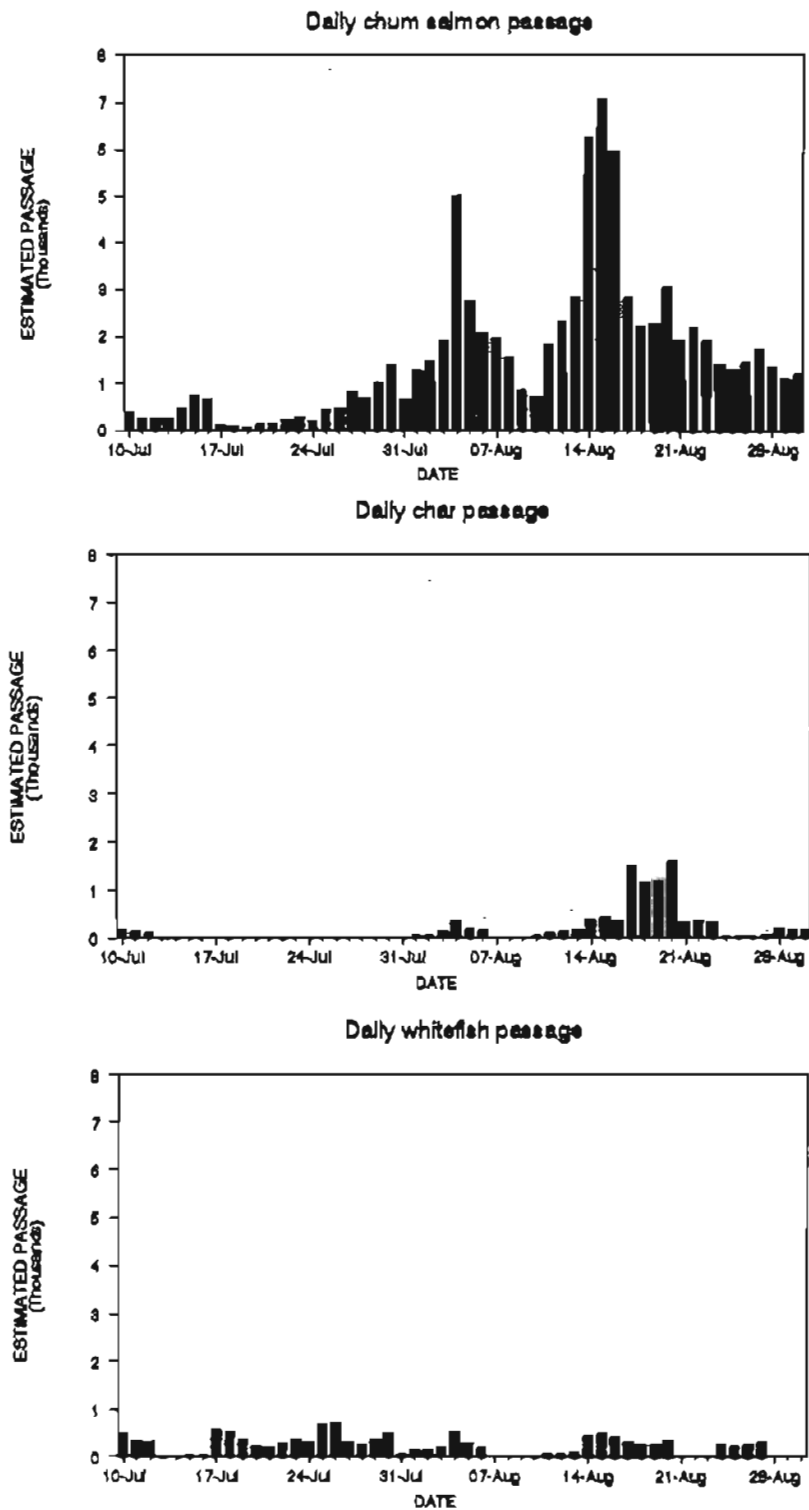


Figure 4. Daily passage estimates of chum salmon, char, and whitefish from 10 July through 30 August, Noatak River sonar, 1991.

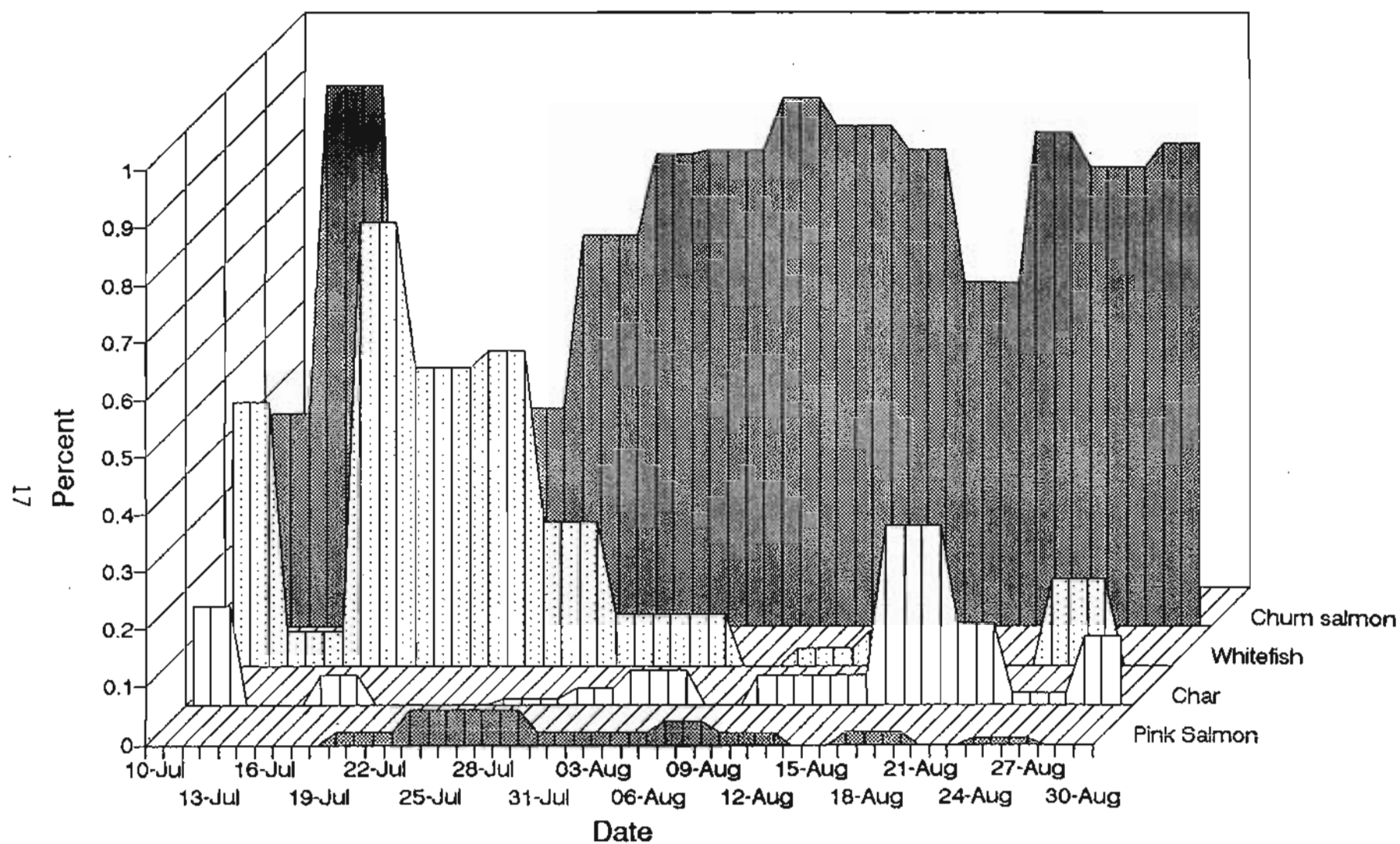


Figure 5. Estimated daily proportions of chum salmon, whitefish, char, and pink salmon from 10 July through 30 August, Noatak River sonar, 1991.

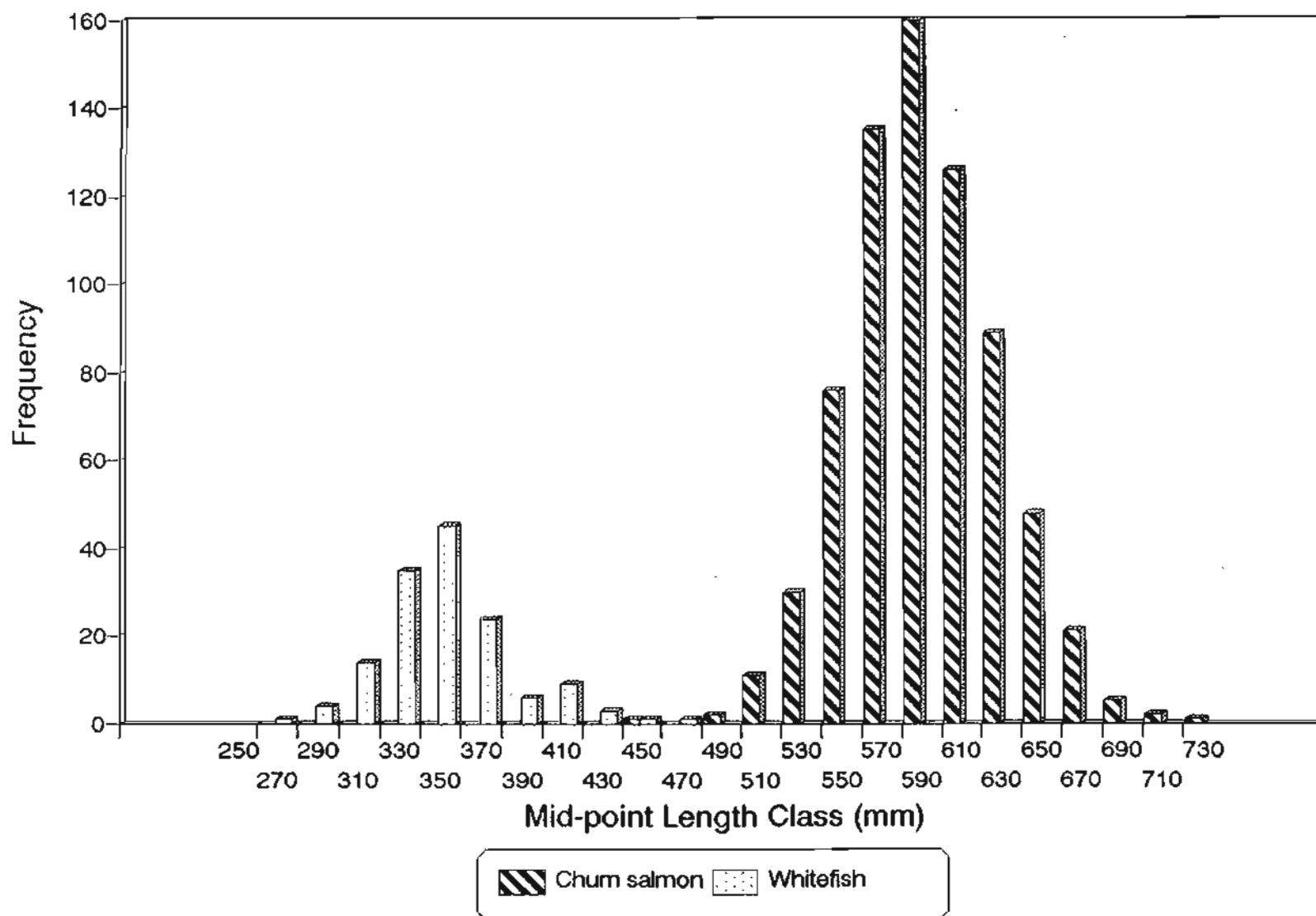


Figure 6. Length distribution of chum salmon and whitefish caught in drift nets at Noatak River sonar, 1991.

APPENDIX A: NET SELECTIVITY PARAMETER FILE USED BY SAS PROGRAM

NINSNORM.DAT: these values were generated from 1990 Noatak data by running NOselect.sas on 31 Oct 1990, excluding all fish which were not caught in one of the the following mesh pairs for that species: chum 5.125, 5.875; char 4.625, 5.125; pink 4.0 5.0 (from yukon 86-89 data: gilled fish only). Then selectivity curve means (SCM's) for 1991 mesh sizes were calculated by assuming that SCM's were proportional to the mesh sizes themselves. Standard deviations were assumed to be the same for all mesh sizes within a species. Minimum fish per 2 bins was 5 for chum, 3 for char. Bin size was 20mm for chum, 40mm for char.

CHAR	2.75	275.3	55.4
CHAR	4.0	440.5	55.4
CHAR	5.0	550.7	55.4
CHAR	6.0	660.8	55.4
CHUM	5.0	547.6	60.5
CHUM	6.0	657.1	60.5
PINK	4.0	366.5	50.2
PINK	5.0	458.2	50.2

APPENDIX B: SAS DATA PROCESSING PROGRAM

```
title1 'Noatak Sonar In-Season Data Processing Program, 1991';

*IDENTIFY PATH OF DIRECTORY IN WHICH TO STORE PERMANENT SAS DATA SETS;
libname save '\sassave';

*SET PAGE LENGTH AND WIDTH FOR OUTPUT;
options linesize=79;
options pagesize=60;

*READ IN RAW DATA FROM FILE PRINTED FROM LOTUS 123;
*CALCULATE DURATION OF COUNTS IN HOURS;
*CALCULATE 15 MINUTE PASSAGE ESTIMATE;
data sonarcts;
    infile 'nlcounts.prn';
    length counter $3;
    informat starttime endtime time5.;
    input month 1 day 3-4 year 6-7 @9 starttime @15 endtime@21counter$
    count1 27-29 count2 33-35 count3 39-41 count4 45-47 count5 51-53;
    count=sum(of count2-count5);
    date=mdy(month,day,year);
    hour=hour(starttime);
    dstime=dhms(date,hour(starttime),minute(starttime),0);

    detime=dhms(date+DATEPART(ENDTIME),hour(endtime),minute(endtime),0);
    hrsdur=(detime-dstime)/3600;
    hourpsg=count/hrsdur;
    min15psg=hourpsg/4;
    dst2hr=round(dstime,7200);
    dst6hr=round(dstime,21600);
    format starttime endtime time5. date date7. dst2hr dst6hr
    datetimel0.;
    label hour ='HOURLY STARTING AT:' hourpsg='HOURLY PASSAGE';
run;

*NOTE: MIN15PSG= ESTIMATED COUNT FOR 15 MINUTES;

data rperiod;
    infile 'rperiod.dat' firstobs=7;
    informat date mmddyy8.;
    input reportno date; *minrange maxrange;
run;
```

APPENDIX B: CONT'D

```
*MERGE REPORT PERIOD INFO WITH THE SONAR DATA FILE;
proc sort data=sonarcts; by date; run;
data sonarcts; merge sonarcts(in=a) rperiod; by date; if a; run;

*OPTIONAL BAR CHARTS OF HOURLY SONAR COUNTS BY DAY;
proc chart data=sonarcts;
    vbar hour / type=mean sumvar=hourpsg discrete;
    by date;
run;

*CALCULATE MEAN ESTIMATED 15 MIN PASSAGE RATES OVER 2, 6, AND 24 HOUR
PERIODS;
proc summary data=sonarcts;
    var min15psg;
    by dst2hr;
    output out=pass2hr mean=meanpass;
run;

proc summary data=sonarcts;
    var min15psg;
    by dst6hr;
    output out=pass6hr mean=meanpass;
run;

proc summary data=sonarcts;
    var min15psg;
    by reportno date;
    output out=pass24hr mean=meanpass;
run;

*CREATE FILES OF ESTIMATED PASSAGE EVERY 2 AND 6 HOURS FOR CONSTRUCTION OF
GRAPHS IN LOTUS 123;
data print; set pass2hr;
file 'n2hrcts.out';
    sumpass=8*meanpass;
    month=month(datepart(dst2hr));
    year=year(datepart(dst2hr));
    day=day(datepart(dst2hr));
    hour=hour(dst2hr);
    put year month day hour sumpass;
    format sumpass 9.0;
run;

data print; set pass6hr;
```

APPENDIX B: CONT'D

```

file 'n6hrcts.out';
    sumpass=24*meanpass;
    year=year(datepart(dst6hr));
    month=month(datepart(dst6hr));
    day=day(datepart(dst6hr));
    hour=hour(dst6hr);
    format sumpass 9.0;
    put year month day hour sumpass;
run;

title2 'Sonar estimates of daily fish passage';
title3 'beyond 20m range';
data dailypsg; set pass24hr (drop= _type_ _freq_);
    dailypsg=96*meanpass;
    format meanpass 8.1 dailypsg 9.0;
    label meanpass='MEAN 15 MIN PASSAGE RATE' dailypsg='DAILY
PASSAGE';
run;
proc print label noobs;
    var reportno date meanpass;
    sum dailypsg;
run;

proc summary data=dailypsg;
    by reportno;
    var dailypsg;
    output out=reptpsg sum=passage;
run;

*
*
*THIS CONCLUDES CALCULATIONS FOR THE SONAR DATA, NOW BEGIN TESTFISH DATA
PROCESSING;
*
*
*
*READ DATA FROM RBASE EXPORT FILE, ONE LINE FOR EACH FISH, PLUS ONE LINE
FOR
ANY DRIFTS DURING WHICH NO FISH WERE CAUGHT;
*CALCULATE EFFORT IN FATHOM HOURS;
*NOTE THERE IS NO CONTINGENCY FOR DRIFTS SPANNING MIDNIGHT;
data nltfish;
    length qmeth qsex $3;
    length meth sex $1;

```

APPENDIX B: CONT'D

```

length species $8;
infile 'e:\rbfiles\nltfish.dlm' delimiter=',';
*PATH;
informat date mmdyy. startout fullout startin fullin time8.;
format date date7. startout fullout startin fullin time5.;
input date tfperiod site mesh fathoms qmeth rangel range2
      startout fullout startin fullin spcode qsex length;
meth=upcase(substr(qmeth,2,1));
sex=upcase(substr(qsex,2,1));
drifsecs = (startin-fullout) + (fullout-startout)/2 +
(fullin-startin)/2;
fathhrs= fathoms*drifsecs/3600;
if spcode=0 then catch=0; else catch=1;
drop qmeth qsex fullout startin fullin drifsecs;
if spcode = 1 then species = 'CHINOOK ';
if spcode = 2 then species = 'CHUM';
if spcode = 3 then species = 'CHAR';
if spcode = 4 then species = 'PIKE';
if spcode = 5 then species = 'PINK';
if spcode = 6 then species = 'SHEEFISH';
if spcode = 7 then species = 'WHITE';
if spcode = 8 then species = 'FLOUNDER';
if spcode = 9 then species = 'OTHER';
if spcode = 10 then species = 'CISCO';
if spcode = 0 or spcode = . then species = 'NONE';
if mesh=2.75 then meshcode=1;
if mesh=4 then meshcode=2;
if mesh=5 then meshcode=3;
if mesh=5.5 then meshcode=4;
if mesh=6 then meshcode=5;
run;

*MERGE REPORT PERIOD INFO WITH TESTFISH DATA FILE;
proc sort data=nltfish; by date; run;
data nltfish; merge nltfish(in=a) rperiod; by date; if a; run;

*GENERATE CPUE DATA FOR COMPARISON WITH DOWNRIVER TESTFISH PROJECT;
data tfishrpt; set nltfish;
  if spcode eq 1 then delete;
  if spcode gt 2 then delete;
  if meshcode eq 5 or meshcode eq 3;
run;

proc sort data=tfishrpt; by mesh date startout;

```

APPENDIX B: CONT'D

```
proc summary data=tfishrpt;
  var fathhrs catch;
  output out=drifcpue mean(fathhrs)=drifteff sum(catch)=drifctch;
  by mesh date startout; run;

proc summary data=drifcpue;
  var drifteff drifctch;
  output out=daycpue sum=dayeff daycatch;
  by mesh date; run;

data daycpue; set daycpue;
  if dayeff gt 0 then daycpue=daycatch/dayeff;
  else daycpue=0;
  format date date7. dayeff daycpue 7.2 daycatch 7.0;
  label dayeff='FATHOM HOURS' daycatch='NUMBER CAUGHT' daycpue='CPUE';
  run;

title2 'DAILY CHUM SALMON CATCH, EFFORT, AND CPUE, BY MESH';
title3 'no adjustments made for net selectivity';
proc print data=daycpue noobs label;
  var date daycatch dayeff daycpue;
  by mesh;
  run;

*CALCULATE EFFORT PER MESH;
proc sort data=nltfish; by date tfperiod mesh startout species; run;
proc summary data=nltfish;
  var fathhrs; id meth rangel range2;
  output out=drifsets mean(fathhrs)=effort;
  by date tfperiod mesh startout;
  run;

*AND CATCH PER MESH PER SPECIES;
proc summary data=nltfish;
  var catch; id meth rangel range2;
  output out=ds2 sum(catch)=sppcatch;
  by date tfperiod mesh startout species;
  run;

proc sort data=ds2; by date tfperiod mesh startout meth rangel range2;
run;
proc transpose data=ds2 out=tfsummar;
  by date tfperiod mesh startout meth rangel range2;
```

APPENDIX B: CONT'D

```
var sppcatch;
id species;
run;

data tfsummar; merge tfsummar drifsets; by date tfperiod mesh startout;
    drftmins=effort*60/25;
run;

data spplist;
    chum=0; char=0; pink=0; white=0; run;

data tfsummar; set tfsummar (in=a drop=_type_ _freq_) spplist;
    if a;
    format date date7. startout time5. effort 8.2;
    label effort='FATHOM HOURS' drftmins='MINUTES DEPLOYED';
run;

proc sort data=tfsummar; by date meth mesh startout; run;
title2 'SUMMARY OF TESTFISH RESULTS';
title3 'only major species listed';
proc print data=tfsummar label noobs;
    var date tfperiod startout meth mesh;
    sum drftmins chum charr pink white;
run;

*AND THEN BY SUMMING EFFORT FOR ALL DRIFTS IN A TFPERIOD WITH A GIVEN
MESH;
data drifsets; set drifsets; if meth='D'; run;
proc sort data=drifsets; by date tfperiod mesh; run;
proc summary data=drifsets;
    var effort;
    output out=effort1 sum=meffort; *(MESH EFFORT);
    by date tfperiod mesh;
run;

*FINALLY, REARRANGE DATA TO PUT EFFORTS FOR ALL MESHES ON A SINGLE LINE;
proc transpose data=effort1 out=effort2;
    var meffort; id mesh;
    by date tfperiod;
run;

data effort; merge effort1 effort2; by date tfperiod;
    drop _name_ _type_ _freq_;
    rename _2d75_ =effort1;
    rename _4      =effort2;
```

APPENDIX B: CONT'D

```

rename _5      =effort3;
rename _5d5    =effort4;
rename _6      =effort5;
format date date7.;
run;

*READ IN AN EXTERNAL FILE WHICH SETS WHICH MESHES WILL BE USED TO ESTIMATE
CPUE FOR EACH SPECIES, AND WHICH SPECIES CATCHES WILL BE ADJUSTED FOR NET
SELECTIVITY;
data specmesh;
    infile 'nlspmesh.dat' firstobs=17;
    length species $ 8;
    length adjust $ 3;
    input species usemesh1-usemesh5 adjust;
run;

*READ NET SELECTIVITY CURVE PARAMETERS (MEAN, STD) FROM AN EXTERNAL FILE;
*REARRANGE NET SELECTIVITY DATA SO THAT ALL THE INFORMATION FOR EACH
SPECIES
IS LOCATED ON EACH LINE;
data nsnormal;
    infile 'nlnsnorm.dat' firstobs=10;
    input species $ mesh selmean stddev;
run;
proc transpose data=nsnormal out=sm;
    var selmean; id mesh;
    by species; run;
data sm; set sm;
    drop _name_;
    rename _2d75 =sm1;
    rename _4    =sm2;
    rename _5    =sm3;
    rename _5d5  =sm4;
    rename _6    =sm5;
run;
proc transpose data=nsnormal out=std;
    var stddev; id mesh;
    by species; run;
data std; set std;
    drop _name_;

```

APPENDIX B: CONT'D

```

rename _2d75 =std1;
rename _4 =std2;
rename _5 =std3;
rename _5d5 =std4;
rename _6 =std5;
run;
data nsnormal; merge nsnormal sm std; by species; run;

*MERGE SPECIES-MESH PAIRING DATA INTO TESTFISH DATA SET;
*DELETE FISH WHICH WERE NOT CAUGHT IN MESHES TARGETING THAT SPECIES;
proc sort data=nltfish; by species; run;
proc sort data=specmesh; by species; run;
data tfsm;
  merge nltfish(in=a) specmesh;
  by species;
  if a;
  array usemesh{5} usemesh1-usemesh5;
  if usemesh{meshcode}=0 then delete;
run;

/*proc datasets library=work; delete testfish; run;*/

*MERGE NET SELECTIVITY CURVE DATA INTO TESTFISH (+SM) DATA SET;
proc sort data=tfsm; by species mesh; run;
data tfsmns; merge tfsm(in=b) nsnormal; by species mesh;
  if b;
run;

/*proc datasets library=work; delete tfsm; run;*/

*MERGE EFFORT DATA INTO TESTFISH (+SM+NS) DATA SET;
*DECLARE ARRAYS;
data tfsmns; set tfsmns; drop fathhrs; run;
proc sort data=tfsmns; by date tfperiod mesh; run;
data tfsmnsef; merge tfsmns(in=c) effort; by date tfperiod mesh;
  if meth='D';
  if c;
  if length=0 then length=selmean;
  array usemesh{5} usemesh1-usemesh5;
  array sm{5} sm1-sm5;
  array zother{5} zother1-zother5;
  array std{5} std1-std5;
  array effort{5} effort1-effort5;
  *FOR MAJOR SPECIES, ADJUST CATCH (I.E., 1 FISH) FOR NET

```

APPENDIX B: CONT'D

```

SELECTIVITY;
  *IF FISH WAS VERY UNLIKELY TO HAVE BEEN CAUGHT IN THIS MESH,
  THEN DO NOT INCLUDE IT;
  zcutoff=1.66;
  meanpdf=(probnorm(zcutoff)-0.5)/zcutoff;
  adjcatch=0.399/meanpdf;
  if adjust='Y' then do;
    z=(length-selmean)/stddev;
    if abs(z)<zcutoff then do;
      pdf=(1/sqrt(2*3.141592654))*exp(-z**2/2);
      adjcatch = 0.399 / pdf;
    end;
  else adjcatch=0;
  end;
  *THEN SUM EFFORT FOR ALL MESHES TARGETING THIS SPECIES DURING THIS TF
  PERIOD;

  *IF SPECIES IS ADJUSTED FOR NET SELECTIVITY, THEN DO NOT CONSIDER THOSE
  MESHES IN WHICH THIS LENGTH FISH IS EXTREMELY UNLIKELY TO HAVE BEEN
  CAUGHT;
  *FINALLY, CALCULATE ADJUSTED CPUE FOR EACH FISH;
  sumeff=0;
  do imesh=1 to 5;
    if adjust='Y' then do;
      zother{imesh}=(length-sm{imesh})/std{imesh};
      if abs(zother{imesh})>zcutoff then usemesh{imesh}=0;
    end;
    if effort{imesh}=. then effort{imesh}=0;
    sumeff=sumeff+effort{imesh}*usemesh{imesh};
  end;
  adjcpue=adjcatch/sumeff;
  format date date7. startout time5.
  z zother1-zother5 5.2 meffort effort1-effort5 sumeff adjcatch 4.1;
run;

/*proc datasets library=work; delete tfsms; run;*/

*OPTIONAL PRINTOUT FOLLOWS: SHOWS INTERMEDIARY CALCULATIONS ON TESTFISH
DATA;
options linesize=120;
data print; set tfsmnsef;
title2 'PART OF DATA SET TFSMNSEF';

```

APPENDIX B: CONT'D

```
title3 'ONE LINE PER FISH, EACH LINE ALSO HAS INFORMATION ON NET  
SELECTIVITY';  
title4 'CURVE PARAMETERS AND EFFORT FOR EACH MESH DRIFTED DURING THAT  
PERIOD';  
run;  
proc print data=print;  
var date startout mesh species length  
z pdf adjcatch meffort  
zother1 zother2 zother3 zother5 sumeff adjcpue;  
run;  
  
*SUM ADJUSTED CPUE FOR EACH SPECIES DURING EACH TESTFISH PERIOD;  
proc sort data=tfsmnsef; by reportno date tfperiod spcode;  
proc summary data=tfsmnsef;  
var adjcpue adjcatch; id startout species;  
output out=spcpue sum=spcpue spcatch;  
by reportno date tfperiod spcode;  
run;  
  
*TRANPOSE BY ALL BUT SPECIES (CODE), CREATING A SEPARATE VARIABLE FOR  
CPUE OF  
EACH SPECIES;  
proc transpose data=spcpue out=spcpwide;  
by reportno date tfperiod;  
var spcpue;  
id spcode;  
run;  
  
proc summary data=spcpue;  
by reportno date tfperiod;  
var spcatch startout;  
output out=catch sum(spcatch)=adjcatch mean(startout)=avestart;  
run;  
  
*SUM CPUE'S FOR ALL SPECIES DURING A GIVEN TESTFISH PERIOD;  
data spcpwide; merge spcpwide catch; by reportno date tfperiod;  
array cpue{10} _1-_10;  
sumcpue=0;  
do i=1 to 10;  
if cpue{i} = . then cpue{i} = 0;  
sumcpue= sumcpue + cpue{i};  
end;  
format date date7. avestart time5. _1-_10 adjcatch sumcpue 6.2;  
run;
```

APPENDIX B: CONT'D

```

/*
*OPTIONAL PRINTOUT FOLLOWS;
title2 'INTERMEDIARY DATA SET WORK.SPCPWIDE: CPUE BY SPECIES CODES'; run;
proc print data=spcpwide noobs label;
  var reportno date tfperiod adjcatch _1-_10 sumcpue;
run;
*/
/*
*CREATE OPTIONAL BAR CHART OF SPECIES CPUE BY TESTFISH PERIOD;
data chartcp; merge spcpue catch; by reportno date tfperiod;
  datetime=dhms(date,hour(avestart),minute(avestart),0);
  format datetime datetime10.;
  label datetime='DATE AND HOUR';
  if spcode<2 or spcode=4 or spcode=6 or spcode>7 then delete;
run;
title2 'TESTFISH CPUE, BY SPECIES, IN ALL TESTFISH PERIODS';
proc chart data=chartcp;
  vbar datetime / sumvar=spcpue subgroup=species discrete;
run;
*/
*SUM CPUE, FOR EACH SPECIES AND FOR ALL SPECIES, ACROSS ALL TESTFISH
PERIODS
  WITHIN EACH REPORTING PERIOD;
*CALCULATE THE AVERAGE TOTAL (ALL SPECIES) CPUE IN EACH REPORT PERIOD;
*COUNT THE NUMBER OF TESTFISH PERIODS IN EACH REPORT PERIOD;
proc sort data=spcpwide; by reportno; run;
proc summary data=spcpwide;
  var _1-_10 sumcpue;
  output out=rncpue sum=rnspcpl-rnspcp10 rnsmdp
    mean(sumcpue)=rnmncp
    n=n;

  by reportno;
run;

*MERGE THE ORIGINAL DATA SET WITH THE SUMMARIZED DATA SET, THEN CALCULATE:
ESTIMATED PROPORTION OF EACH SPECIES DURING EACH TESTFISH PERIOD,
ESTIMATED PROPORTION OF EACH SPECIES DURING EACH REPORT PERIOD,
AND A WEIGHTED SQUARED DEVIATION OF THE TESTFISH PERIOD PROPORTION FROM
THE REPORT PERIOD PROPORTION;
data varcalc;

```

APPENDIX B: CONT'D

```

merge spcpwide rncpue;
by reportno;
array cpue{10} 1-10;
array rnspcp{10} rnspcp1-rnspcp10;
array phatpr{10} phatpr1-phatpr10;
array phatrp{10} phatrp1-phatrp10;
array sqrdev{10} sqrdev1-sqrdev10;
weight=sumcpue/rnmncp;
do i=1 to 10;
    phatpr{i}=cpue{i}/sumcpue;
    phatrp{i}=rnspcp{i}/rnmncp;
    sqrdev{i}=(weight**2)*(phatpr{i}-phatrp{i})**2;
end;
label phatpr1='CHINOOK' phatpr2='CHUM' phatpr3='CHAR' phatpr4='PIKE'
phatpr5='PINK' phatpr6='SHEEFISH' phatpr7='WHITE' phatpr8='FLOUNDER'
phatpr9='OTHER' phatpr10='CISCO';
format phatpr1-phatpr10 3.2;
format adjcatch 5.0;
format date date7. avestart time5.;
run;

*OPTIONAL PRINTOUT OF SPECIES PROPORTIONS BY TESTFISH PERIOD;
proc sort data=varcalc; by reportno date tfperiod;
title2 'ESTIMATED SPECIES PROPORTIONS AND TOTAL ADJUSTED CATCH BY TESTFISH
PERIOD';
run;
proc print label data=varcalc;
    var reportno date adjcatch
        phatpr1 phatpr2 phatpr3 phatpr4 phatpr5
        phatpr6 phatpr7 phatpr8 phatpr9 phatpr10;
run;

*SUM THE SQUARED DEVIATIONS BY REPORT PERIOD;
proc sort data=varcalc; by reportno; run;
proc summary data=varcalc;
    var sqrdev1-sqrdev10 adjcatch;
    id phatpr1-phatpr10 n date;
    output out=varprop sum=smsqdv1-smsqdv10 adjcatch;
    by reportno;
run;

*AND CALCULATE THE VARIANCE OF THE REPORT PERIOD PROPORTION (COCHRAN
1977);

```

APPENDIX B: CONT'D

```

data varprop; set varprop (drop = _type _freq_);
  phatoth=phatrp1+phatrp4+phatrp6+phatrp8+phatrp10+phatrp9;
  format phatrp1-phatrp10 phatoth stdprp1-stdprp10 3.2;
  format adjcatch 4.0 date date7.;
  label phatrp1='CHINOOK' phatrp2='CHUM' phatrp3='CHAR' phatrp4='PIKE'
        phatrp5='PINK' phatrp6='SHEEFISH' phatrp7='WHITE' phatrp8='FLOUNDER'
        phatrp9='OTHER' phatrp10='CISCO' phatoth='OTHER';
  label stdprp2='CHUM S.E.' stdprp3='CHAR S.E.' stdprp5='PINK S.E.'
        stdprp7='WHITE S.E.';
  array varprp{10} varprp1-varprp10;
  array smsqdv{10} smsqdv1-smsqdv10;
  array stdprp{10} stdprp1-stdprp10;
  array cvprop{10} cvprop1-cvprop10;
  array phatrp{10} phatrp1-phatrp10;
  do i = 1 to 10;
    varprp[i]=smsqdv[i]/(n*(n-1));
    stdprp[i]=sqrt(varprp[i]);
    if phatrp[i] gt 0 then cvprop[i]=stdprp[i]/phatrp[i];
    else cvprop[i]=0;
  end;
run;

title2 'ESTIMATED SPECIES PROPORTIONS AND STANDARD ERRORS';
title3 'BY REPORT PERIOD';
title4 'major species only';
proc print label data=varprop noobs;
  var reportno date adjcatch phatrp2 phatrp3 phatrp5 phatrp7 phatoth
      stdprp2 stdprp3 stdprp5 stdprp7;
run;

*
*
*NOW MERGE DATA SET CONTAINING COUNTS WITH DATA SET CONTAINING
PROPORTIONS,
AND CALCULATE SPECIES PASSAGE ESTIMATES AND THEIR ESTIMATED VARIANCE;
*
*;

data reptstat;
  merge varprop retpasg;

```

APPENDIX B: CONT'D

```

by reportno;
array phatrp{10} phatrp1-phatrp10;
array varpsgl{10} varpsgl1-varpsgl10;
array varprp{10} varprp1-varprp10;
array psg{10} psg1-psg10;
do i=1 to 10;
    psg{i}=phatrp{i}*passage;
    varpsgl{i}=(passage**2)*varprp{i};
end;
format passage psg1-psg10 8. varprp1-varprp10
        varpsgl1-varpsgl10 e9. phatrp1-phatrp10 5.3;
run;

*OPTIONAL PRINTOUT FOLLOWS;
/*
title2 'Dataset reptstat';
proc print data=reptstat label;
    var reportno date passage phatrp1-phatrp10
        varprp1-varprp10 psg1-psg10 varpsgl1-varpsgl10;
run;
*/

data reptstat; set reptstat (drop = _type_ _freq_);
* file 'nlrepsht.dat';                                *PATH;
    label reportno='REPORTING PERIOD' date='ENDING ON';
    label psg1='CHINOOK' psg2='CHUM' psg3='CHAR' psg4='PIKE' psg5='PINK'
        psg6='SHEEFISH' psg7='WHITE' psg8='FLOUNDER' psg9='OTHER'
psg10='CISCO';
    format psg1-psg10 7. varpsgl1-varpsgl10 e9.;
* put reportno date psg1-psg10 / varpsgl1-varpsgl10;
run;

title2 'ESTIMATED FISH SPECIES PASSAGE BY REPORTING PERIOD';
proc print label noobs data=reptstat;
    var reportno date;
    sum psg2 psg3 psg5 psg7 psg1 psg4 psg6 psg8 psg10 psg9;
run;

proc summary data=reptstat;
    var psg1-psg10 varpsgl1-varpsgl10 date;
    output out=cumstat sum(psg1-psg10)=cumpsgl1-cumpsgl10
        sum(varpsgl1-varpsgl10)=varcpl1-varcpl10

```

APPENDIX B: CONT'D

```

                                max(date)=enddate;

run;

data cumstat; set cumstat (drop=_type_);
  rename _freq_=nreports;
run;

proc transpose data=cumstat out=cs1;
  by nreports;
  var cumpsg1-cumpsg10; run;
data cs1; set cs1;
  label coll='PASSAGE TO DATE';
  rename coll=cumulpsg;
  length species $ 11;
  if _name_ = 'CUMPSG1 ' then species = ' 9 CHINOOK ';
  if _name_ = 'CUMPSG2 ' then species = ' 1 CHUM';
  if _name_ = 'CUMPSG3 ' then species = ' 2 CHAR';
  if _name_ = 'CUMPSG4 ' then species = ' 8 PIKE';
  if _name_ = 'CUMPSG5 ' then species = ' 3 PINK';
  if _name_ = 'CUMPSG6 ' then species = ' 6 SHEEFISH';
  if _name_ = 'CUMPSG7 ' then species = ' 4 WHITE';
  if _name_ = 'CUMPSG8 ' then species = ' 7 FLOUNDER';
  if _name_ = 'CUMPSG9 ' then species = '10 OTHER';
  if _name_ = 'CUMPSG10' then species = ' 5 CISCO';
  drop _name_;
run;

proc transpose data=cumstat out=cs2;
  var varcpl-varcp10; run;
data cs2; set cs2;
  rename coll=variance;
run;

data cumstat2; merge cs1 cs2;
  stderr=sqrt(variance);
  cv=stderr/cumulpsg;
  format cumulpsg 8. variance e10. stderr 7. cv 4.3;
  label nreports='REPORTS TO DATE'
        stderr='ESTIMATED STANDARD ERROR' cv='COEFFICIENT OF VARIATION';
run;

proc sort data=cumstat2; by species; run;
title2 'CUMULATIVE STATISTICS BY SPECIES';
proc print noobs label;
  var nreports species cumulpsg stderr cv;
run;

```

APPENDIX C: SUMMARY OF DRIFT TEST-NETTING RESULTS, 10 JULY - 30 AUGUST

Mon	Day	Mesh ^a	Strt ^b Rng1	Strt ^c Rng2	Mins ^d Out	Fthm ^e Hrs	Chum	Number Caught Char	White	Pink
Jul	10	6	15	0	12.5	5.2	.	.	.	.
Jul	10	6	0	50	10.8	4.5	.	.	.	.
Jul	10	5	15	0	14.0	5.8	.	.	.	.
Jul	10	5	0	50	11.3	4.7	.	.	.	.
Jul	10	4	15	0	11.5	4.8	.	.	2	.
Jul	10	4	0	50	11.0	4.6	.	.	.	.
Jul	10	6	15	0	11.8	4.9	.	.	.	.
Jul	10	6	0	50	11.6	4.8	.	.	.	.
Jul	10	5	15	0	12.5	5.2	.	.	.	.
Jul	10	5	0	50	12.4	5.2	.	.	.	.
Jul	10	4	0	50	11.7	4.9	.	.	.	.
Jul	11	6	15	0	12.6	5.2	1	.	.	.
Jul	11	6	0	50	12.4	5.2	1	.	.	.
Jul	11	5	15	0	12.4	5.2	.	.	.	.
Jul	11	5	0	50	11.8	4.9	.	.	.	.
Jul	11	4	15	0	12.0	5.0	.	.	.	.
Jul	11	4	0	50	11.6	4.8	.	.	.	.
Jul	11	6	15	0	12.3	5.1	.	.	.	.
Jul	11	6	0	50	11.4	4.7	.	.	.	.
Jul	11	5	15	0	12.2	5.1	.	.	.	.
Jul	11	5	0	50	11.5	4.8	.	.	.	.
Jul	11	4	0	50	11.6	4.8	.	.	.	.
Jul	12	6	15	0	11.0	4.6	.	.	.	.
Jul	12	6	0	50	9.5	4.0	3	.	.	.
Jul	12	5	15	0	10.0	4.2	.	.	.	.
Jul	12	5	0	50	10.0	4.2	.	.	1	.
Jul	12	4	15	0	10.0	4.2	.	.	.	.
Jul	12	4	0	50	9.5	4.0	.	.	.	.
Jul	12	6	15	0	10.5	4.4	.	1	.	.
Jul	12	6	0	50	10.0	4.2	.	.	.	.
Jul	12	5	15	0	10.0	4.2	.	.	.	.
Jul	12	5	0	50	9.5	4.0	.	.	.	.
Jul	12	4	0	50	9.5	4.0	.	.	.	.
Jul	13	4	0	50	16.6	6.9	.	.	.	.
Jul	13	5	15	0	16.5	6.9	.	.	.	.
Jul	13	5	0	50	16.4	6.8	1	.	.	.
Jul	13	6	15	0	16.1	6.7	.	.	.	.
Jul	13	6	0	50	15.9	6.6	.	.	.	.
Jul	13	2.75	15	0	16.4	6.9	.	.	.	.
Jul	13	2.75	0	50	16.3	6.8	.	.	1	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Jul	13	5	15	0	17.0	7.1	4	.	.	.
Jul	13	5	0	50	15.4	6.4	.	.	.	.
Jul	13	6	15	0	17.9	7.5	3	.	.	.
Jul	13	6	0	50	16.7	7.0	.	.	.	.
Jul	14	6	0	50	17.5	7.3	1	.	.	.
Jul	14	6	0	50	16.5	6.9	.	.	.	.
Jul	14	5	15	0	16.4	6.8	.	.	.	.
Jul	14	5	0	50	16.9	7.1	1	.	.	.
Jul	14	2.75	0	50	16.8	7.0	.	.	.	.
Jul	14	2.75	0	50	17.0	7.1	.	.	.	.
Jul	14	4	15	0	16.9	7.0	.	.	.	.
Jul	14	4	0	50	16.6	6.9	.	.	.	.
Jul	14	6	15	0	16.4	6.8	.	.	.	.
Jul	14	6	0	50	16.5	6.9	.	.	.	.
Jul	15	6	0	50	16.0	6.7	.	.	.	.
Jul	15	4	15	0	16.5	6.9	.	.	.	.
Jul	15	4	0	50	15.5	6.5	.	.	.	.
Jul	15	2.75	15	0	19.0	7.9	.	.	.	.
Jul	15	2.75	0	50	16.2	6.8	.	.	.	.
Jul	15	2.75	23	0	16.8	7.0	.	.	.	.
Jul	15	2.75	0	50	16.3	6.8	.	.	.	.
Jul	15	5	23	0	16.6	6.9	.	.	.	.
Jul	15	5	0	50	16.2	6.7	3	.	.	.
Jul	15	6	23	0	16.5	6.9	12	.	.	.
Jul	15	6	0	50	16.4	6.8	1	.	.	.
Jul	16	6	23	0	15.0	6.3	.	.	.	.
Jul	16	6	0	50	15.5	6.5	.	.	.	.
Jul	16	5	23	0	15.0	6.3	.	.	.	.
Jul	16	5	0	50	15.0	6.3	.	.	.	.
Jul	16	2.75	23	0	14.5	6.0	.	1	.	.
Jul	16	2.75	0	50	15.0	6.3	.	.	.	.
Jul	16	2.75	23	0	14.5	6.0	.	.	.	.
Jul	16	2.75	0	50	14.5	6.0	.	.	.	.
Jul	16	4	23	0	14.5	6.0	.	.	.	.
Jul	16	4	0	50	15.0	6.3	.	.	.	.
Jul	16	6	23	0	14.5	6.0	.	.	.	.
Jul	16	6	0	50	15.0	6.3	.	.	.	.
Jul	15	6	23	0	16.5	6.9	1	.	.	.
Jul	17	6	23	0	16.7	6.9	.	.	.	.
Jul	17	6	0	50	16.5	6.9	.	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Jul	17	5	23	0	16.8	7.0	1	.	.	.
Jul	17	5	0	50	16.2	6.8	2	.	.	.
Jul	17	2.75	23	0	16.8	7.0	.	.	3	.
Jul	17	2.75	0	50	16.9	7.1	.	.	.	.
Jul	17	2.75	23	0	17.2	7.2	.	.	3	.
Jul	17	2.75	0	50	16.3	6.8	.	.	.	.
Jul	17	4	0	50	17.0	7.1	.	.	.	.
Jul	17	4	23	0	16.3	6.8	.	.	.	.
Jul	17	6	23	0	16.3	6.8	.	.	.	.
Jul	17	6	0	50	16.3	6.8	.	.	.	.
Jul	18	6	23	0	16.1	6.7	.	.	.	.
Jul	18	6	0	50	16.1	6.7	.	.	.	.
Jul	18	4	23	0	16.2	6.7	.	.	.	.
Jul	18	4	0	50	16.1	6.7	.	.	.	.
Jul	18	2.75	23	0	16.3	6.8	.	.	.	.
Jul	18	2.75	0	50	16.2	6.7	.	.	.	.
Jul	18	2.75	23	0	16.3	6.8	.	.	2	.
Jul	18	2.75	0	50	16.4	6.8	.	.	1	.
Jul	18	5	23	0	16.2	6.7	.	.	.	.
Jul	18	5	0	50	16.1	6.7	1	.	.	.
Jul	18	6	23	0	16.1	6.7	2	.	.	.
Jul	18	6	0	50	16.1	6.7	.	.	.	.
Jul	19	6	23	0	13.5	5.6	.	.	.	.
Jul	19	6	0	50	15.0	6.3	.	1	.	.
Jul	19	5	23	0	15.0	6.3	.	.	.	.
Jul	19	5	0	50	14.5	6.0	.	.	.	.
Jul	19	2.75	23	0	17.0	7.1	.	.	3	.
Jul	19	2.75	0	50	15.0	6.3	.	.	6	.
Jul	19	2.75	23	0	15.0	6.3	.	.	.	.
Jul	19	2.75	0	50	15.0	6.3	.	.	.	.
Jul	19	4	23	0	14.5	6.0	.	.	.	.
Jul	19	4	0	50	15.5	6.5	.	.	.	.
Jul	19	6	23	0	15.0	6.3	.	.	.	.
Jul	19	6	0	50	15.0	6.3	.	.	.	.
Jul	20	6	23	0	16.5	6.9	.	.	.	.
Jul	20	6	0	50	16.0	6.7	.	.	.	.
Jul	20	5	23	0	16.5	6.9	.	.	.	.
Jul	20	5	0	50	15.9	6.6	.	.	.	.
Jul	20	2.75	23	0	16.4	6.8	.	.	.	.
Jul	20	2.75	0	50	16.5	6.9	.	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Jul	20	2.75	23	0	16.5	6.9	.	.	2	.
Jul	20	2.75	0	50	16.5	6.9	.	.	.	.
Jul	20	4	23	0	17.0	7.1	.	.	.	.
Jul	20	4	0	50	15.6	6.5	.	.	.	.
Jul	20	6	23	0	17.2	7.2	5	.	.	.
Jul	20	6	23	0	17.2	7.2	.	.	.	.
Jul	20	6	0	50	16.1	6.7	.	.	.	.
Jul	21	6	23	0	17.1	7.1	.	.	.	.
Jul	21	6	0	50	17.1	7.1	.	.	.	.
Jul	21	4	23	0	17.0	7.1	.	.	.	.
Jul	21	4	0	50	16.8	7.0	.	.	.	.
Jul	21	2.75	23	0	17.0	7.1	.	.	.	.
Jul	21	2.75	0	50	17.0	7.1	.	.	.	.
Jul	21	2.75	23	0	17.3	7.2	.	.	.	.
Jul	21	2.75	0	50	16.8	7.0	.	.	.	.
Jul	21	5	23	0	16.8	7.0	.	.	.	.
Jul	21	5	0	50	16.0	6.7	.	.	.	.
Jul	21	6	23	0	16.8	7.0	6	.	.	1
Jul	21	6	0	50	16.3	6.8	.	.	.	.
Jul	22	6	23	0	16.2	6.8	1	.	.	.
Jul	22	6	0	50	16.1	6.7	4	.	.	.
Jul	22	5	23	0	16.0	6.7	.	.	.	.
Jul	22	5	0	50	16.1	6.7	.	.	.	.
Jul	22	2.75	23	0	16.7	7.0	.	.	1	.
Jul	22	2.75	0	50	16.6	6.9	.	.	.	.
Jul	22	2.75	23	0	16.6	6.9	.	.	2	.
Jul	22	6	23	0	16.0	6.7	.	.	.	.
Jul	22	6	0	50	16.0	6.7	.	.	.	.
Jul	22	4	23	0	16.2	6.8	.	.	2	2
Jul	22	4	0	50	17.0	7.1	.	.	.	.
Jul	23	4	23	0	16.7	7.0	.	.	.	.
Jul	23	6	23	0	18.9	7.9	4	.	.	.
Jul	23	6	0	50	16.3	6.8	3	.	.	.
Jul	23	2.75	23	0	16.7	6.9	.	.	2	.
Jul	23	2.75	0	50	16.2	6.7	.	.	1	.
Jul	23	2.75	23	0	17.3	7.2	.	.	8	.
Jul	23	2.75	0	50	16.7	6.9	.	.	.	.
Jul	23	5	23	0	16.3	6.8	.	.	.	.
Jul	23	5	0	50	16.3	6.8	.	.	.	.
Jul	23	6	23	0	16.3	6.8	2	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Jul	23	6	0	50	16.3	6.8	.	.	.	.
Jul	24	6	23	0	5.0	2.1	.	.	.	.
Jul	24	6	0	50	15.0	6.3	.	.	.	.
Jul	24	5	23	0	15.0	6.3	.	.	.	.
Jul	24	5	0	50	15.0	6.3	.	.	.	.
Jul	24	2.75	23	0	15.0	6.3	.	.	6	.
Jul	24	2.75	0	50	15.0	6.3	.	.	3	.
Jul	24	2.75	23	0	14.5	6.0	.	.	1	.
Jul	24	2.75	0	50	15.0	6.3	.	.	.	.
Jul	24	4	23	0	15.0	6.3	1	.	.	.
Jul	24	4	0	50	15.0	6.3	.	.	.	.
Jul	24	6	23	0	15.0	6.3	1	.	.	.
Jul	24	6	0	50	15.0	6.3	1	.	.	.
Jul	25	6	23	0	16.1	6.7	2	.	.	.
Jul	25	6	0	50	16.1	6.7	.	.	.	.
Jul	25	4	23	0	16.1	6.7	.	.	.	2
Jul	25	4	0	50	16.2	6.8	.	.	.	.
Jul	25	2.75	23	0	16.7	7.0	.	.	11	.
Jul	25	2.75	0	50	16.4	6.8	.	.	8	.
Jul	25	2.75	23	0	16.5	6.9	.	.	.	.
Jul	25	2.75	0	50	16.4	6.8	.	.	.	.
Jul	25	5	23	0	14.9	6.2	2	.	.	.
Jul	25	5	0	50	16.1	6.7	2	.	.	.
Jul	25	6	23	0	16.3	6.8	2	.	.	.
Jul	25	6	0	50	16.1	6.7	4	.	.	.
Jul	26	6	23	0	15.0	6.3	2	.	.	.
Jul	26	6	0	50	15.0	6.3	2	.	.	.
Jul	26	5	23	0	14.5	6.0	.	.	.	.
Jul	26	5	0	50	15.0	6.3	3	.	.	.
Jul	26	2.75	23	0	15.5	6.5	.	.	3	.
Jul	26	2.75	0	50	15.0	6.3	.	.	.	.
Jul	26	2.75	23	0	15.0	6.3	.	.	3	.
Jul	26	2.75	0	50	15.0	6.3	.	.	.	.
Jul	26	4	23	0	15.0	6.3	.	1	2	3
Jul	26	4	0	50	15.0	6.3	.	.	.	1
Jul	26	6	23	0	15.0	6.3	6	.	.	.
Jul	26	6	0	50	15.0	6.3	1	.	.	.
Jul	27	6	23	0	16.2	6.7	6	.	.	.
Jul	27	6	0	50	16.1	6.7	2	.	.	.
Jul	27	4	23	0	16.5	6.9	.	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Jul	27	4	0	50	17.0	7.1	.	.	.	1
Jul	27	2.75	23	0	16.8	7.0	.	.	.	.
Jul	27	2.75	0	50	16.5	6.9	.	.	.	.
Jul	27	2.75	23	0	16.1	6.7	.	.	.	.
Jul	27	2.75	0	50	16.1	6.7	.	.	3	.
Jul	27	5	23	0	16.0	6.7	1	.	.	3
Jul	27	5	0	50	15.9	6.6	.	.	.	.
Jul	27	6	23	0	15.9	6.6	5	.	.	.
Jul	27	6	0	50	16.1	6.7	1	.	.	.
Jul	28	6	23	0	16.6	6.9	9	.	.	.
Jul	28	6	0	50	16.4	6.8	1	.	.	.
Jul	28	5	23	0	16.2	6.7	.	.	.	.
Jul	28	5	0	50	16.2	6.7	.	.	.	.
Jul	28	2.75	23	0	17.3	7.2	.	.	.	.
Jul	28	2.75	0	50	16.1	6.7	.	.	3	.
Jul	28	2.75	23	0	16.2	6.8	.	.	.	.
Jul	28	2.75	0	50	16.2	6.7	.	.	.	.
Jul	28	4	23	0	16.2	6.8	.	.	.	3
Jul	28	4	0	50	16.3	6.8	1	.	.	1
Jul	28	6	23	0	16.1	6.7	.	.	.	.
Jul	28	6	0	50	16.0	6.7	.	.	.	.
Jul	29	6	23	0	16.6	6.9	24	.	.	.
Jul	29	6	0	50	11.1	4.6	4	.	.	.
Jul	29	4	23	0	11.3	4.7	.	.	1	2
Jul	29	4	0	50	11.2	4.7	.	.	.	.
Jul	29	2.75	23	0	11.5	4.8	.	.	.	.
Jul	29	2.75	0	50	11.3	4.7	.	.	2	.
Jul	29	2.75	23	0	11.3	4.7	.	.	7	.
Jul	29	2.75	0	50	11.2	4.7	.	.	.	.
Jul	29	5	23	0	11.2	4.6	.	.	.	.
Jul	29	5	0	50	11.0	4.6	3	.	.	.
Jul	29	6	23	0	11.2	4.7	.	.	.	.
Jul	29	6	0	50	11.0	4.6	.	.	.	.
Jul	30	6	23	0	9.4	3.9	.	.	.	.
Jul	30	6	0	50	9.7	4.1	9	.	.	.
Jul	30	5	23	0	9.5	4.0	3	1	.	.
Jul	30	5	0	50	9.9	4.1	2	.	.	1
Jul	30	2.75	23	0	10.4	4.4	.	.	1	.
Jul	30	2.75	0	50	9.8	4.1	.	.	.	.
Jul	30	2.75	23	0	10.2	4.2	.	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Ju1	30	2.75	0	50	10.1	4.2	.	.	.	.
Ju1	30	4	23	0	9.6	4.0	.	.	.	.
Ju1	30	4	0	50	10.1	4.2	.	.	.	.
Ju1	30	6	23	0	10.3	4.3	11	.	.	.
Ju1	30	6	0	50	10.1	4.2	.	.	.	.
Ju1	31	6	23	0	9.9	4.1	.	.	.	.
Ju1	31	6	23	0	10.0	4.2	10	.	.	.
Ju1	31	6	0	50	10.1	4.2	.	.	.	.
Ju1	31	5	23	0	10.4	4.3	1	.	.	.
Ju1	31	5	0	50	9.9	4.1	.	.	.	.
Ju1	31	2.75	23	0	10.2	4.2	.	.	.	.
Ju1	31	2.75	0	50	10.1	4.2	.	.	.	.
Aug	1	6	23	0	16.0	6.7	5	.	.	.
Aug	1	6	0	50	16.1	6.7	4	.	.	.
Aug	1	5	23	0	16.1	6.7	3	.	.	1
Aug	1	5	0	50	16.1	6.7	2	.	.	.
Aug	1	2.75	23	0	16.5	6.9	.	.	.	.
Aug	1	2.75	0	50	16.2	6.8	.	.	.	.
Aug	1	2.75	23	0	16.6	6.9	.	.	.	.
Aug	1	2.75	0	50	16.3	6.8	.	.	.	.
Aug	1	4	23	0	16.1	6.7	.	1	.	.
Aug	1	4	0	50	16.0	6.7	.	.	.	.
Aug	1	6	23	0	15.1	6.3	2	.	.	1
Aug	1	6	0	50	16.1	6.7	9	.	.	.
Aug	2	2.75	23	0	12.4	5.2	.	.	4	.
Aug	2	2.75	0	50	14.9	6.2	.	.	.	.
Aug	2	4	0	50	15.0	6.3	.	.	.	.
Aug	2	6	23	0	15.0	6.3	.	.	.	.
Aug	2	6	0	50	14.9	6.2	2	.	.	.
Aug	2	6	23	0	14.9	6.2	.	.	.	.
Aug	2	6	0	50	15.0	6.3	4	.	.	.
Aug	2	5	23	0	15.3	6.4	3	1	.	.
Aug	2	5	0	50	14.8	6.2	.	.	.	.
Aug	2	2.75	23	0	13.4	5.6	.	.	1	.
Aug	2	2.75	0	50	15.1	6.3	.	.	.	.
Aug	3	2.75	23	0	16.2	6.8	.	.	1	.
Aug	3	2.75	0	50	16.4	6.8	.	.	1	.
Aug	3	5	23	0	16.1	6.7	2	.	.	.
Aug	3	5	0	50	16.0	6.7	6	.	.	.
Aug	3	6	23	0	16.4	6.8	2	.	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Aug	3	6	0	50	16.1	6.7	2	.	.	.
Aug	3	6	23	0	16.2	6.7	4	.	.	.
Aug	3	6	0	50	21.2	8.8	5	.	.	.
Aug	3	4	23	0	16.6	6.9	3	.	.	.
Aug	3	4	0	50	16.1	6.7	.	1	.	1
Aug	3	2.75	23	0	16.4	6.8	.	.	.	.
Aug	3	2.75	0	50	15.9	6.6	.	.	1	.
Aug	4	6	23	0	16.1	6.7	6	.	.	.
Aug	4	6	0	50	16.3	6.8	15	.	.	.
Aug	4	4	23	0	11.6	4.8	.	1	.	1
Aug	4	4	0	50	11.1	4.6	.	1	.	2
Aug	4	2.75	23	0	11.5	4.8	.	.	1	.
Aug	4	2.75	0	50	11.3	4.7	.	.	1	.
Aug	4	2.75	23	0	11.6	4.8	.	.	.	.
Aug	4	2.75	0	50	11.3	4.7	.	.	.	.
Aug	4	5	23	0	11.3	4.7	14	.	.	1
Aug	4	5	0	50	11.1	4.6	7	.	.	.
Aug	4	6	23	0	11.8	4.9	15	.	.	.
Aug	4	6	0	50	11.4	4.8	12	.	.	.
Aug	5	6	23	0	11.5	4.8	26	.	.	.
Aug	5	6	0	50	11.1	4.6	4	.	.	.
Aug	5	5	23	0	11.1	4.6	.	.	.	.
Aug	5	5	0	50	11.3	4.7	3	.	.	.
Aug	5	2.75	23	0	11.3	4.7	.	.	1	.
Aug	5	2.75	0	50	11.3	4.7	.	.	1	.
Aug	5	2.75	23	0	16.4	6.8	.	.	1	.
Aug	5	2.75	0	50	16.3	6.8	.	.	.	.
Aug	5	4	23	0	16.1	6.7	.	.	.	.
Aug	5	4	0	50	16.0	6.7	.	.	.	2
Aug	5	6	23	0	16.2	6.7	5	.	.	.
Aug	5	6	0	50	16.0	6.7	7	.	.	.
Aug	6	6	23	0	9.8	4.1	.	.	.	.
Aug	6	6	0	50	9.8	4.1	2	.	.	.
Aug	6	4	23	0	9.9	4.1	.	.	.	.
Aug	6	4	0	50	10.1	4.2	.	.	.	.
Aug	6	2.75	23	0	10.3	4.3	.	.	3	.
Aug	6	2.75	0	50	9.9	4.1	.	.	.	.
Aug	6	2.75	23	0	15.3	6.4	.	.	.	.
Aug	6	2.75	0	50	15.3	6.4	.	.	2	.
Aug	6	5	23	0	14.9	6.2	4	1	.	.

(continued)

APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Aug	6	5	0	50	14.8	6.2	2	.	.	.
Aug	6	6	23	0	14.9	6.2	6	.	.	.
Aug	6	6	0	50	15.0	6.3	3	.	.	.
Aug	7	6	23	0	16.2	6.7	6	.	.	.
Aug	7	5	23	0	16.2	6.7	1	.	.	.
Aug	7	2.75	23	0	16.3	6.8	.	.	.	.
Aug	7	2.75	23	0	16.2	6.7	.	.	.	.
Aug	7	4	23	0	16.1	6.7	.	.	.	2
Aug	7	6	23	0	16.2	6.7	15	.	.	.
Aug	8	6	23	0	16.1	6.7	.	.	.	.
Aug	8	4	23	0	16.2	6.7	.	.	.	1
Aug	8	2.75	23	0	16.3	6.8	.	.	.	.
Aug	8	2.75	23	0	16.3	6.8	.	.	.	.
Aug	8	5	23	0	16.1	6.7	4	.	.	.
Aug	8	6	23	0	16.0	6.7	.	.	.	.
Aug	9	6	23	0	15.0	6.3	3	.	.	.
Aug	9	6	0	50	10.0	4.2	1	.	.	.
Aug	9	5	23	0	15.2	6.3	.	.	.	.
Aug	9	2.75	23	0	15.2	6.3	.	.	.	.
Aug	9	6	23	0	15.1	6.3	28	.	.	.
Aug	9	4	23	0	15.0	6.3	.	.	.	.
Aug	10	6	23	0	16.9	7.0	.	.	.	.
Aug	10	4	23	0	16.2	6.8	.	.	.	.
Aug	10	2.75	23	0	16.3	6.8	.	.	.	.
Aug	10	2.75	23	0	16.3	6.8	.	.	.	.
Aug	10	5	23	0	16.1	6.7	.	.	.	.
Aug	10	6	23	0	15.8	6.6	.	.	.	.
Aug	11	6	23	0	16.2	6.7	9	1	.	.
Aug	11	5	23	0	16.0	6.7	.	.	.	.
Aug	11	2.75	23	0	16.5	6.9	.	.	.	.
Aug	11	2.75	23	0	16.7	7.0	.	.	.	.
Aug	11	4	23	0	16.3	6.8	.	.	.	.
Aug	11	6	23	0	16.0	6.6	3	.	.	.
Aug	12	6	23	0	11.1	4.6	5	.	.	.
Aug	12	4	23	0	16.0	6.6	.	.	.	.
Aug	12	2.75	23	0	16.4	6.8	.	.	.	.
Aug	12	2.75	23	0	16.4	6.8
Aug	12	5	23	0	16.2	6.8	3	1	.	.
Aug	12	6	23	0	12.6	5.2	3	.	.	.
Aug	13	6	23	0	15.0	6.3	7	.	.	.

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APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Aug	13	5	23	0	15.1	6.3	4	1	.	.
Aug	13	2.75	23	0	15.5	6.5	.	.	1	.
Aug	13	4	23	0	16.0	6.7	.	.	1	1
Aug	13	6	23	0	15.0	6.3	12	.	.	.
Aug	14	6	23	0	16.9	7.1	.	1	.	.
Aug	14	4	23	0	16.0	6.7	.	.	.	.
Aug	14	2.75	23	0	16.5	6.9	.	.	2	.
Aug	14	2.75	0	50	16.3	6.8	.	.	.	.
Aug	14	5	0	50	16.1	6.7	.	.	.	.
Aug	14	6	0	50	15.9	6.6	.	.	.	.
Aug	14	6	23	0	16.0	6.7	1	.	.	.
Aug	14	6	0	50	11.0	4.6	9	.	.	.
Aug	15	6	23	0	16.1	6.7	.	.	.	.
Aug	15	5	23	0	16.0	6.7	2	.	.	.
Aug	15	2.75	0	50	16.2	6.7	.	.	.	.
Aug	15	4	0	50	16.3	6.8	.	.	.	.
Aug	15	6	0	50	16.4	6.8	3	.	.	.
Aug	16	6	23	0	15.0	6.3	1	.	.	.
Aug	16	4	23	0	15.0	6.3	.	.	.	.
Aug	16	2.75	23	0	15.3	6.4	.	.	.	.
Aug	16	2.75	23	0	15.5	6.5	.	.	.	.
Aug	16	5	23	0	14.9	6.2	3	.	.	.
Aug	16	6	23	0	15.0	6.3	10	.	.	.
Aug	17	6	23	0	16.0	6.7	9	.	.	.
Aug	17	5	23	0	16.1	6.7	4	1	.	.
Aug	17	2.75	23	0	16.1	6.7	.	2	.	.
Aug	17	2.75	23	0	16.0	6.7	.	1	1	.
Aug	17	4	23	0	15.9	6.6	.	.	.	1
Aug	17	6	23	0	15.5	6.5	5	.	.	.
Aug	18	6	23	0	16.0	6.7	4	.	.	.
Aug	18	4	23	0	15.9	6.6	.	.	4	1
Aug	18	2.75	23	0	16.4	6.8	.	.	.	.
Aug	18	2.75	23	0	16.5	6.9	.	.	1	.
Aug	18	5	23	0	16.1	6.7	5	.	.	.
Aug	18	6	23	0	16.0	6.7	3	.	.	.
Aug	19	6	23	0	16.1	6.7	6	.	.	.
Aug	19	5	23	0	15.8	6.6	1	.	.	.
Aug	19	2.75	23	0	16.1	6.7	.	3	.	.
Aug	19	2.75	23	0	16.2	6.8	.	.	1	.
Aug	19	4	23	0	16.1	6.7	2	.	.	.

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APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Aug	19	6	23	0	15.9	6.6	.	.	.	.
Aug	20	6	23	0	16.1	6.7	1	.	.	.
Aug	20	4	23	0	12.7	5.3	.	.	.	.
Aug	20	2.75	23	0	15.2	6.3	.	1	.	.
Aug	20	2.75	23	0	15.1	6.3	.	12	1	.
Aug	20	5	23	0	14.7	6.1	.	1	.	.
Aug	20	6	23	0	15.0	6.3	8	.	.	.
Aug	21	6	23	0	16.3	6.8	2	.	.	.
Aug	21	5	23	0	16.4	6.8	1	.	.	.
Aug	21	2.75	23	0	16.4	6.8	.	.	.	.
Aug	21	2.75	23	0	16.4	6.9	.	.	.	.
Aug	21	4	23	0	16.2	6.7	.	2	.	1
Aug	21	6	23	0	16.1	6.7	1	.	.	.
Aug	22	6	23	0	16.5	6.9	9	.	.	.
Aug	22	4	23	0	16.3	6.8	1	.	.	.
Aug	22	5	23	0	16.5	6.9	6	.	.	.
Aug	22	6	23	0	16.4	6.8	9	.	.	.
Aug	23	6	23	0	14.9	6.2	1	.	.	.
Aug	23	5	23	0	9.9	4.1	1	.	.	.
Aug	23	2.75	23	0	15.3	6.4	.	1	.	.
Aug	23	2.75	23	0	15.0	6.3	.	.	.	.
Aug	23	4	23	0	14.8	6.2	.	.	.	.
Aug	23	6	23	0	15.0	6.3	7	1	.	.
Aug	24	6	23	0	16.1	6.7	3	.	.	.
Aug	24	4	23	0	16.1	6.7	1	.	.	.
Aug	24	2.75	23	0	17.4	7.3	.	.	.	.
Aug	24	2.75	23	0	14.3	5.9	.	.	.	.
Aug	24	5	23	0	13.8	5.7	2	.	.	.
Aug	24	6	23	0	13.4	5.6	.	.	.	.
Aug	25	6	23	0	16.9	7.0	14	.	.	.
Aug	25	5	23	0	16.2	6.7	.	.	.	.
Aug	25	2.75	23	0	16.4	6.8	.	.	.	.
Aug	25	4	23	0	16.3	6.8	.	.	.	1
Aug	25	6	23	0	16.2	6.7	15	.	.	.
Aug	26	6	23	0	16.2	6.7	.	.	.	.
Aug	26	4	23	0	16.2	6.8	.	.	.	.
Aug	26	2.75	23	0	16.8	7.0
Aug	26	2.75	23	0	16.4	6.9
Aug	26	5	23	0	16.4	6.8	12	.	.	.
Aug	26	6	23	0	16.1	6.7	5	.	.	.

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APPENDIX C: CONT'D

Mon	Day	Mesh	Strt Rng1	Strt Rng2	Mins Out	Fthm Hrs	Chum	Number Char	Caught White	Pink
Aug	27	6	23	0	14.8	6.2	1	.	.	.
Aug	27	5	23	0	15.1	6.3	3	.	.	.
Aug	27	2.75	23	0	15.1	6.3	.	.	5	.
Aug	27	2.75	23	0	15.3	6.4	.	1	2	.
Aug	27	4	23	0	15.3	6.4	1	.	.	.
Aug	27	6	23	0	14.9	6.2	7	.	.	.
Aug	28	6	23	0	16.3	6.8	2	.	.	.
Aug	28	4	23	0	16.1	6.7	.	.	.	.
Aug	28	2.75	23	0	16.4	6.8	.	.	.	.
Aug	28	2.75	23	0	16.6	6.9	.	.	.	.
Aug	28	5	23	0	16.2	6.7	6	.	.	.
Aug	28	6	23	0	16.2	6.7	12	1	.	.
Aug	29	6	23	0	16.4	6.8	4	.	.	.
Aug	29	5	23	0	16.7	6.9	5	2	.	.
Aug	29	2.75	23	0	16.5	6.9	.	1	.	.
Aug	29	2.75	23	0	16.4	6.8	1	.	.	.
Aug	29	4	23	0	16.1	6.7	.	.	.	.
Aug	29	6	23	0	16.0	6.7	4	.	.	.
Aug	30	6	23	0	15.0	6.3	1	.	.	.
Aug	30	4	23	0	14.9	6.2	.	.	.	.
Aug	30	2.75	23	0	15.0	6.3	.	1	.	.
Aug	30	5	23	0	16.3	6.8	1	.	.	.
Aug	30	6	23	0	14.8	6.1	8	.	.	.
						=====	=====	=====	=====	=====
						2884	701	46	131	37

- (a) Gillnet stretched mesh (in inches).
- (b) Nearshore starting range of net deployment (in meters).
- (c) Offshore starting range of net deployment (in meters).
- (d) Total minutes net deployed.
- (e) Area of net in square fathoms X hours deployed.

